American Machinist

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SPARK PLUG FOR INDUSTRY

FORD'S million-car program for 1935, Oldsmobile's doubling of capacity, Packard's millions expended on equipment for its new line of cars, and the ambitious plans of many other makers are demonstrating that the automobile industry is doing its full share to promote industrial recovery. These commitments reflect a genuine confidence in the recuperative powers of the American people.

Here is a concerted move by private enterprise that bids well so to accelerate the tempo of business generally that millions now seeking work may be restored to productive jobs. How much better is this spontaneous remedy than the palliative of "pump priming" with public funds!

Everything is in favor of such a stimulus by and within private enterprise. It is efficient because of the fundamental need for profitable operation. It is direct because it improves the standard of living which is the only basis of any real prosperity. It constitutes a net gain because it avoids the disillusioning after effects of increased taxation. It is widespread because capital goods, consumer goods, supplies and services all join with the automotive industry in its return to a higher rate of activity.

BY THEIR sound appraisal of economic conditions, by their belief in the country's emergence from the depression, and by their willingness to act upon their convictions with concrete plans and constructive expenditures, the leaders of the automotive industry have performed a distinct service to the nation. Such vigorous action has infinitely more weight on the economic scales than reams of rhetorical discussion.

To these men and the great industry they represent we devote this number of *American Machinist*. We are fortunate in being able to include statements by a few of them which outline their ideas and objectives for the coming year.

WE BELIEVE IN UP-TO-DATE EQUIPMENT

An interview with Alvan Macauley, President of the Packard Motor Car Company and President of the Automobile Manufacturers Association

ALVAN MACAULEY

A VISIT to the Packard plant impresses one with its serviceable simplicity. The buildings are almost severely plain in architectural design, but when one inspects the manufacturing equipment, he is immediately impressed with its accuracy and efficiency.

The plant seems to be a brick and steel personification of its head, Alvan Macauley. He is a man of simple tastes and democratic manner who in a few minutes convinces one of his great pride in the Packard plant and organization, and of his unbounded faith in the future of the automobile industry.

When asked about his plant policies Mr. Macauley replied, "Here at Packard we are thorough believers in up-to-date, high grade equipment. Our period of real growth began when we abandoned the handicraft methods used on our first models and started to mechanize our manufacturing facilities."

When questioned about the claim, frequently expressed, that mechanization had been overdone, Mr. Macauley made vigorous denial. "Such contentions," he said, "are the result of loose thinking on the subject of economics. If we get down to fundamentals, industry is the source of wealth for all our citizens. It follows then that if industry is efficient living standards will rise.

"There is no better example than that of the automobile to prove that people are demanding finer goods all the time," continued Mr. Macauley. "We build a quality product and constantly strive to improve it and also to make it available to more and more people. To do this we need up-to-date equipment. This is not a theory but a practical working policy as you can see by the physical condition of our plant.

"Our willingness at this time to add greatly to our plant machinery reflects our confidence in the belief that the American people will buy increasing numbers of fine cars of lower price if they are made available. For this reason we are now in the midst of a program of equipment installation that will enable us to build such cars."

K. T. KELLER

President, Dodge Brothers Corporation

THE AUTOMOBILE'S PART IN RECOVERY

AMONG the many heartening demonstrations of what for want of a better term I might call the "courage of American industry," none has approached the sheer grit and foresighted vision with which the automobile industry has, especially during the past two years, taken the lead in industrial recovery.

During times when the entire country was engulfed by propaganda for or against this or that condition, the one industry that resolutely refused to succumb to "jitters" was that which continued to provide the greater part of the civilized world with personal as well as commercial transportation.

While the motor car industry of today no longer is a rollicking youngster (only the other day we, of Dodge, ourselves observed the twentieth anniversary of the company's founding), it retains the youthful spirit of constant progress that permits nothing about motor car development ever to grow old.

About this time a year ago, the industry's statisticians could report a 25 per cent increase over the business of 1932. As we approach the closing of another year, indications are that the business of 1934 will top that of 1933 again by a substantial margin. The replacement market is absorbing all new vehicles sold during the present year. Employment has gained as the year progressed and at times approached the levels of 1929, while hourly wages exceeded the highest 1929 rates. The tax yield on new vehicles has climbed to new heights, and millions of men are again employed directly and indirectly on Federal Aid and state roads and on local highways.

The active part which the automobile industry has played in the demonstration of the country's recuperative powers is of course not confined to the leaders. Much of the support has come from the contagious faith of the "little fellows," the tradesmen, the white collar workers and others whose optimism, multiplied many times, spread to the higher places until it mounted to the waves of confidence which we see everywhere today. The industry's workers, too, have played their parts—the men in the shops, at drafting boards, behind machines and along assembly lines.

It is well that these things are so, because the automobile industry, reaching into every nook and cranny of our productive life, makes work and wages not merely on its own factory payrolls, but on those of a multitude of other basic industries—producing steel, gasoline, lubricating oils, rubber, plate glass, nickel, lead, upholstering materials, leather, cotton, wool—to all these the motor car industry is perhaps the largest single customer.

Conditions would not be as they are, had automobile men ever been satisfied with their achievements. During the whole evolution of the car, from the horseless carriage to the streamlined marvels you will shortly see at the shows and in dealers' showrooms, automobile design has improved in beauty, speed, safety, comfort and dependability at a rate and with a persistence that are absolutely without parallel in history.

GENERAL MOTORS TRAINS ITS FOREMEN

WILLIAM S. KNUDSEN

An Interview with William S. Knudsen, Executive Vice-President, General Motors

ALWAYS the key man in automobile manufacturing, the foreman today finds his job is more difficult than ever, because of its growing technical complexity, and because of the new industrial relations that have come in with various employee representation plans. Mr. Knudsen holds strong views on the necessity for clothing the foreman with authority that corresponds with his responsibilities. He believes that group leaders should be abolished and that there should be a reasonable ratio between the number of workers and foremen. Twenty men to a foreman is about right for the average automobile shop department in his estimation.

Mr. Knudsen expresses his feelings about the question thus: "The foreman has two major duties. The first is his duty to the article being made, and the second is his duty to his men. The second is as important as the first.

"At times, we have had to choose between a man of high ability, technically, and a man with somewhat less technical ability, but more able to handle help, which in itself is an art. In the latter case, he must have sufficient knowledge to be fully conversant with the quality and what is a reasonable quantity to be expected. Above all, he must be a man.

"I believe there should be one man to give the foreman orders. This does not mean that we cannot give him information, instructions or suggestions, but there should be a definite person to give him orders. This relates not only to his material, but to his tools, quality, costs and safety. Definite lines of authority should be established, so that the foreman will know what he is expected to do and can properly represent his men.

"The personnel department has the responsibility of filling requisitions made by the foreman for men. If the human material out at the gate is not what the foreman wants, I am in favor of giving all possible leeway to help get him the type of man he needs. In those plants where we have had the best foremen control, there has been the least labor trouble. First of all, the personnel department should have a good, up-to-date file of the inefficient and shiftless, so that even in times of shortage, we do not get these men back in the plant.

"I feel that we are not getting a new deal in industry, but that we are going back to the old deal in industry which existed previous to the extremely rapid developments subsequent to the war. I refer to the shop management which dealt with men in great masses right after the war, rather than with the departments.

"I refer to the practice which gradually left the fore-

GENERAL MOTORS' EXECUTIVE TRAINING PROGRAM

OUTLINE OF PRINTED MATERIAL

SECTION-A- MANAGEMENT AND THE EXECUTIVE JOB.
1-THE PLACE OF MANAGEMENT IN MODERN INDUSTRY
2-PRINCIPLES OF EFFICIENT ORGANIZATION.
3-ANALYSIS OF THE EXECUTIVE JOB.

SECTION-B- PLANNING.
1-PLANNING IN AN INDUSTRIAL ENTERPRISE.
2-PLANNING IN THE DEPARTMENT.
3-THE DEVELOPMENT OF PLANNING ABILITY.

SECTION-C- QUALITY CONTROL AND WASTE ELIMINATION.
1-THE CONTROL OF QUALITY.
2-THE CONTROL OF SCRAP.
3-THE CONTROL OF WASTE.
4-WHAT IS INSPECTION?
5-THE INSPECTION AND SALVAGE DEPARTMENTS.

SECTION-D- EQUIPMENT.
1-THE FUNDAMENTALS OF EQUIPMENT CONTROL.
2-TOOL CONTROL.
3-THE TOOL AND MAINTENANCE DEPARTMENTS.

SECTION-E- BUILDING AND MAINTAINING THE ORGANIZATION.
1-BUILDING THE DEPARTMENT ORGANIZATION.
2-THE PERSONNEL DEPARTMENT.
3-THE CONTROL OF LABOR TURNOVER.
4-PROPER SUPERVISION.

SECTION-F- PRINCIPLES OF HANDLING MEN
1-PERSONNEL RELATIONS IN INDUSTRY-HISTORICAL EVOLUTION.
2-DEALING WITH MEN-INDIVIDUAL DIFFERENCES.
3-DEALING WITH MEN-HUMAN MOTIVES AND DESIRES.
4-DEALING WITH MEN-INFLUENCE OF THE GROUP.
5-DEALING WITH MEN-PROBLEMS IN HUMAN BEHAVIOR.
6-DEALING WITH MEN-INTELLIGENCE AND TRAINING.
7-HANDLING MEN-GETTING ALONG WITH PEOPLE.
8-HANDLING MEN-DIFFICULTIES WITH SUBORDINATES.
9-HANDLING MEN-GIVING AND RECEIVING ORDERS.
10-INCENTIVES-EMPLOYEE MORALE AND MORALE CONTROL.
11-SECURING CO-OPERATION.
12-JUDGING AND RATING MEN.

SECTION-G- EMPLOYEE RELATIONS.
1-THE BACKGROUND OF EMPLOYEE REPRESENTATION.
2-TYPES AND OBJECTIVES OF EMPLOYEE REPRESENTATION.
3-RESULTS OBTAINED WITH EMPLOYEE REPRESENTATION PLANS.
4-PLANS OF EMPLOYEE REPRESENTATION IN GENERAL MOTORS.
5-THE EXECUTIVE'S RELATIONSHIP IN EMPLOYEE REPRESENTATION PLANS.

SECTION-H- INCENTIVES.
1-WAGES.
2-THE RELATION OF THE EXECUTIVE TO WAGE QUESTIONS.

SECTION-I- POLICIES.
1-THE EXECUTIVE AND COMPANY POLICIES.

SECTION-J- SAFETY.
1-THE SAFETY PROGRAM.
2-THE PROBLEM OF WORKMEN'S COMPENSATION.

SECTION-K- JOB STUDY.
1-THE METHODS OF WORK DEPARTMENT
2-PRINCIPLES OF JOB STUDY.
3-TIME AND MOTION STUDY.

SECTION-L- TRAINING.
1-THE PROBLEM OF TRAINING IN INDUSTRY.
2-TRAINING AND THE DEPARTMENT.
3-METHODS OF APPLYING TRAINING.

SECTION-M- HOUSEKEEPING.
1-INDUSTRIAL HOUSEKEEPING.

SECTION-N- FUNDAMENTALS OF ECONOMICS
1-DEVELOPMENT OF ECONOMIC ORGANIZATION.
2-MODERN ECONOMIC ORGANIZATION
3-ELEMENTS OF ECONOMICS.

SECTION-O- FINANCIAL ORGANIZATION AND CONTROL OF BUSINESS.
1-INVESTED CAPITAL
2-BORROWED CAPITAL.
3-FINANCIAL ANALYSIS.

SECTION-P- BUDGETS.
1-BUSINESS CONDITIONS.
2-FORECASTING.
3-DEPARTMENTAL BUDGETS.

SECTION-Q- DEPARTMENTAL COST CONTROL METHODS.
1-DEPARTMENTAL COST REPORTS.
2-DIRECT MATERIALS COST
3-DIRECT LABOR COST
4-DEPARTMENTAL EXPENSES
5-GENERAL OVERHEAD.

SECTION-R- PERSONAL CHARACTERISTICS.
1-PERSONAL ANALYSIS.

SECTION-S- GENERAL.
1-THE REQUIREMENTS OF MODERN INDUSTRIAL LEADERSHIP.

man with a gang of men with only the privilege of being called down for something, but with most of his duties criss-crossed by organization lines of other kinds. He couldn't hire his men; sometimes he couldn't fire them. Most of the time he had little to do with the planning of the job he had in charge, and often the tools were never inspected by him until the job was set up.

"The industrial science I look forward to will be the relationship that we establish on the basis of cooperation between the men and the foremen. Here is our problem, and it should be our problem for years to come. The biggest thing before industry is to get better management out of all departments, and through cooperative methods give more and better work, so that the public interest in our product can be retained, and our future assured."

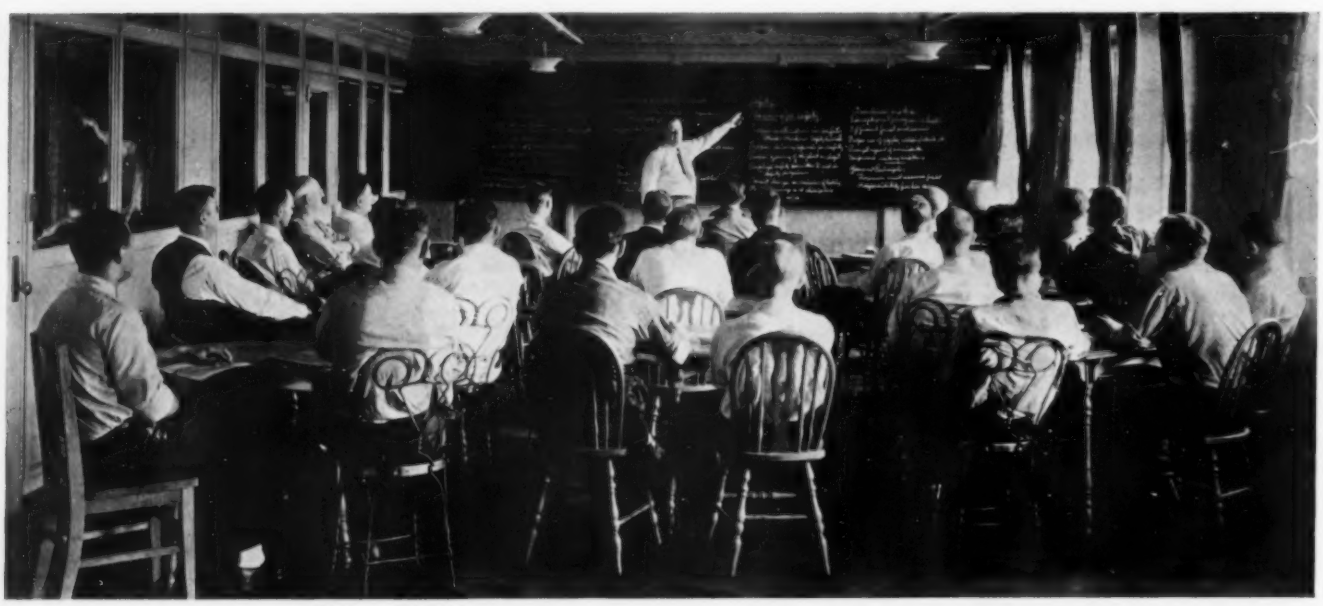
In line with the principles set down by Mr. Knudsen more than 5,000 foremen in manufacturing plants of the General Motors Corporation have taken special training in the past few months to learn the science of industrial relations, especially as it pertains to closer cooperation with their men. The instruction is intended to define the position of the foreman under collective bargaining rights that employees now have with management, as well as to make foremanship more responsive in relaying ideas up or down through plant organization.

The courses which originate in the General Motors Institute at Flint, Mich., were first conceived seven years ago, but the current training is far more extensive and widely attended than any previously offered. Instruction continues for several weeks and is based on the outline of printed material which is given on the preceding page.

Foremen who are conveniently near Flint attend the conferences at the Institute. In remote centers, members of the Institute Faculty visit the plant and lead the foreman conferences. In other cases, these conferences are led by members of the plant organization who have received special training at the Institute. Each conference is limited to 25 men in order to be sure that opportunity is given for answering personal questions and analyzing individual problems. This general discussion helps to clarify perplexing situations presented during every conference.

Specifically, the aims and operations of employee representation are analyzed from the viewpoint of the worker; differences in individual desires and incentives are studied. Ways and means to reach a better understanding are discussed to insure improved supervision policies. Cooperative methods, the judging of men, group morale, transmitting orders and other vital subjects receive special attention. The foremen also study corporation organization, planning, control of materials and waste, equipment handling and the science of personnel work, so that management problems can be appreciated.

Mr. Knudsen expresses satisfaction with the progress already achieved along the lines of foremen training laid down. He sees the need, however, for even greater concentration on the problems of the foreman, and he expects that the work of the ensuing year will be even more productive of better relationship between management and men, and of more efficient operation of the various corporation sub-divisions.



A group of foremen at the Olds Motor Works, at Lansing, typifies the meetings held in General Motors plants for instruction in handling men, promoting shop safety, improving working conditions, increasing efficiency and many other points in plant operation

A STIMULUS TO CAPITAL GOODS

R. B. ELLIOT
Vice-President in Charge of Operations, The Nash Motors Company

WHILE some industries are still hesitant, the manufacture of automobiles has definitely rebounded from the low point of the depression. The first three quarters of 1934 saw the production of passenger cars 30 per cent ahead of the like period of 1933. It is a source of satisfaction to us that Nash's improvement was well above this average increase.

I am convinced that 1935 will mark a further step on the road to recovery and that the heavy industries that lagged during 1934 will join in. It is only natural and in accordance with previous history for periods of revival that goods sold directly to the consumer even when they involve sizable expenditures, as in the case of automobiles, respond first to the demand for an improved standard of living. It takes time for this stimulus to work back to the equipment and other capital goods industries but this phase of the upswing is inevitable.

The success of our cars we attribute to our design and our readiness to adopt manufacturing methods that represent an advance in precision and economy. We are aware of the part that makers of metal-working equipment have played in developing products that have meant so much to the improvement of the cars we are now able to build.

The courage and resourcefulness which these manufacturers have displayed in proceeding with research and redesign during lean years of meager sales has resulted in a wide range of new machines and devices of great potential value to all makers of metal products. With a better year in prospect there can be little doubt that this display of initiative will be rewarded by increased sales.

According to most economists an improvement in the heavy industries is all that is needed for greater reemployment and a subsequent betterment of business generally. Automobile manufacture and other consumer industries have shown the way. The time is now ripe for the others to follow.

As exemplified by this huge body press, automobile plants now hum with thousands of machines, busy at the job of turning out new models to tempt prospective buyers during 1935

Helical Gears for the Nash Transmission

A set of dies used in the Ajax forging machine shows the successive steps taken in forming the clutch shaft without waste of stock

QUIETNESS and easy shifting are all important in a modern automobile transmission. Nash has met these requirements by an all helical geared unit in which particular attention has been given to the manufacture of smooth running gears; a combination clutch and helical spline arrangement permits speed selection with a minimum of effort.

In addition, the Nash transmission possesses a ruggedness which reflects sound design and a production set-up that has been developed from this manufacturer's years of experience. The load-carrying parts in the transmission consists of clutch shaft, drive shaft, countershaft cluster gear, second speed gear, sliding gear, reverse idler gear, and high and second speed gear clutch, outer and inner.

First speed and reverse are engaged by the sliding gear which operates on a helical spline with a lead to correspond to the lead of the mating helical gear on the countershaft cluster. Second and high speeds are selected by means of a double-action clutch provided with synchronizing cones to facilitate quiet meshing.

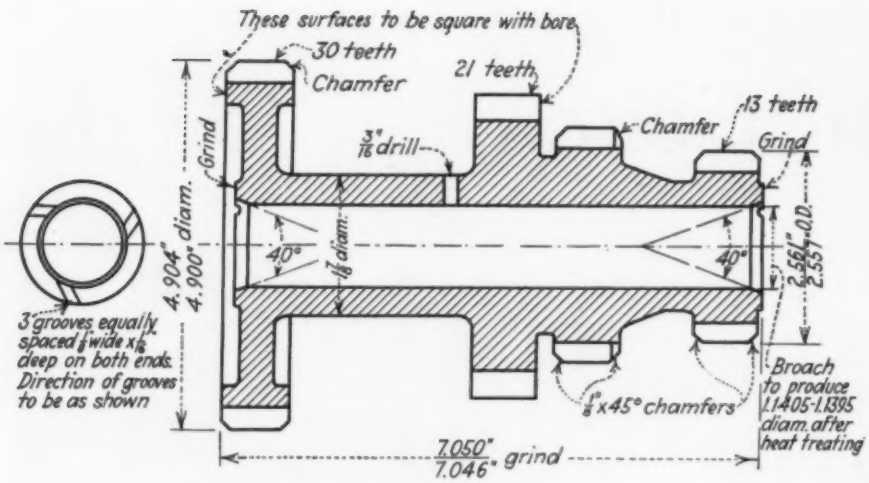
All of the eight transmission parts named above are made of SAE 2350 steel forgings with the carbon content held within 0.45-0.50 instead of the ten-point tolerance usually permitted for this specification. No bar stock is used as rolled. While the forging of these parts is an extra operation its cost is offset by a saving in material, and its use is fully justified by the greatly improved durability of the parts caused by grain refinement and uniformity of structure resulting from the hot working.

With the exception of the inner gear clutch, the parts are upset from bar stock in Ajax forging machines in dies designed to give greatest economy of material. For example, holes are pierced in the second speed gear, sliding gear, reverse idler and outer clutch ring, and a recess is extruded into the clutch shaft by upsetting the stock without loss from slugs. Because of its double recess, the inner clutch member is not suited to this method of forging and consequently is formed under a drop hammer.

Accuracy of the transmission parts starts with the forging operation. The parts are held within $\frac{1}{16}$ in. all around on their main dimensions which gives the cutting tools a chance to get under the scale with little loss of metal during machining.

Straight nickel steel, as called for by the SAE specification used, must be carefully heat-treated before entering the machining departments if good results are to be obtained. If annealed to too soft a state, the steel tends to roll up on the tool and tear, making a good finish impossible. If left too tough, the work causes the tools to wear rapidly, making all operations slow and costly.

To avoid these two undesirable results the metal must be conditioned to the proper point between the troublesome extremes. Nash has developed a combination annealing and normalizing proc-



Countershaft Gear Operations

Operation	Machine
Drill, bore and ream hole; face hub; rough turn 30-tooth gear	Jones & Lamson two-spindle turret lathe
Face hub to length	Le Blond lathe
Chamfer both ends	Aurora vertical drill
Broach hole	Oilgear broaching machine
Rough cut 30-tooth gear	Barber Colman hobber
Rough turn and face	Fay lathe
Undercut 30-tooth gear	Fay lathe
Finish face and turn	Fay lathe
Rough cut 21 teeth	Gould & Eberhardt hobber
Rough cut 13 teeth	Barber Colman hobber
Drill 3/16-in. hole	Leland Gifford drill
Mill oil grooves	U. S. hand mill
Grind face of 30-tooth gear	Landis grinder
Rough cut 16-tooth gear	Fellows gear shaper
Finish cut 16-tooth gear	Fellows gear shaper
Finish cut 13-tooth gear	Fellows gear shaper
Finish cut 21-tooth gear	Fellows gear shaper
Finish cut 30-tooth gear	Fellows gear shaper
Chamfer 16-tooth gear	Peerless chamfering machine
Wash	Washing machine
File teeth and burr	
Wash and inspect	
Burnish 13-tooth gear	Fellows burnishing machine
Burnish 16-tooth gear	Fellows burnishing machine
Burnish 21-tooth gear	Fellows burnishing machine
Burnish 30-tooth gear	Fellows burnishing machine
Wash and inspect	
Harden	
Temper	
Wire brush	
Polish for scleroscope and test	
Press in two bushings	Air press
Flare two bushings	Le Blond lathe
Swedge broach bushings	Press
Diamond bore bushings to size	Sebastian lathe
Grind inner hub	No. 1 Landis grinder
Grind hub to length	Heald vertical grinder
Grind O.D. on large gear	
Lap 13-tooth gear	Fellows outboard lapping machine
Lap 16-tooth gear	Fellows outboard lapping machine
Lap 21-tooth gear	Fellows outboard lapping machine
Lap 30-tooth gear	Fellows outboard lapping machine
Clean	
Silent test and inspect	

ess that achieves this condition. This is done in a continuous straight-line furnace which has been equipped with the necessary close temperature control to give the rate of cooling required. Leeds & Northrup recording pyrometers are used for this purpose. The treatment consists in raising the forgings to 1600 F. until heated uniformly throughout, dropping them rapidly to 1250 F., just above the critical temperature, and then cooling them slowly (at 20 deg. an hour) to 950 F. From this temperature they are allowed to cool in air. After tumbling, the parts are ready for the machining operations.

Excessive grain growth, which has a bad effect on finish and quality, is avoided by the short length of time the work is held above the critical temperature of the steel. The slow cooling through the critical range anneals the steel sufficiently to make it free machining.

Countershaft Gear Rough Drilled

The largest driving member in the transmission and the one having the most work on it is the countershaft gear, sometimes called the cluster gear. This part has integrally forged gears, having 30, 21, 16 and 13 helical teeth respectively. In its finished form the countershaft gear has a bore throughout its entire length about 1⅛ in. in diameter and 7 in. long. This is not forged in the stock but rough drilled, which forms the first machining operation.

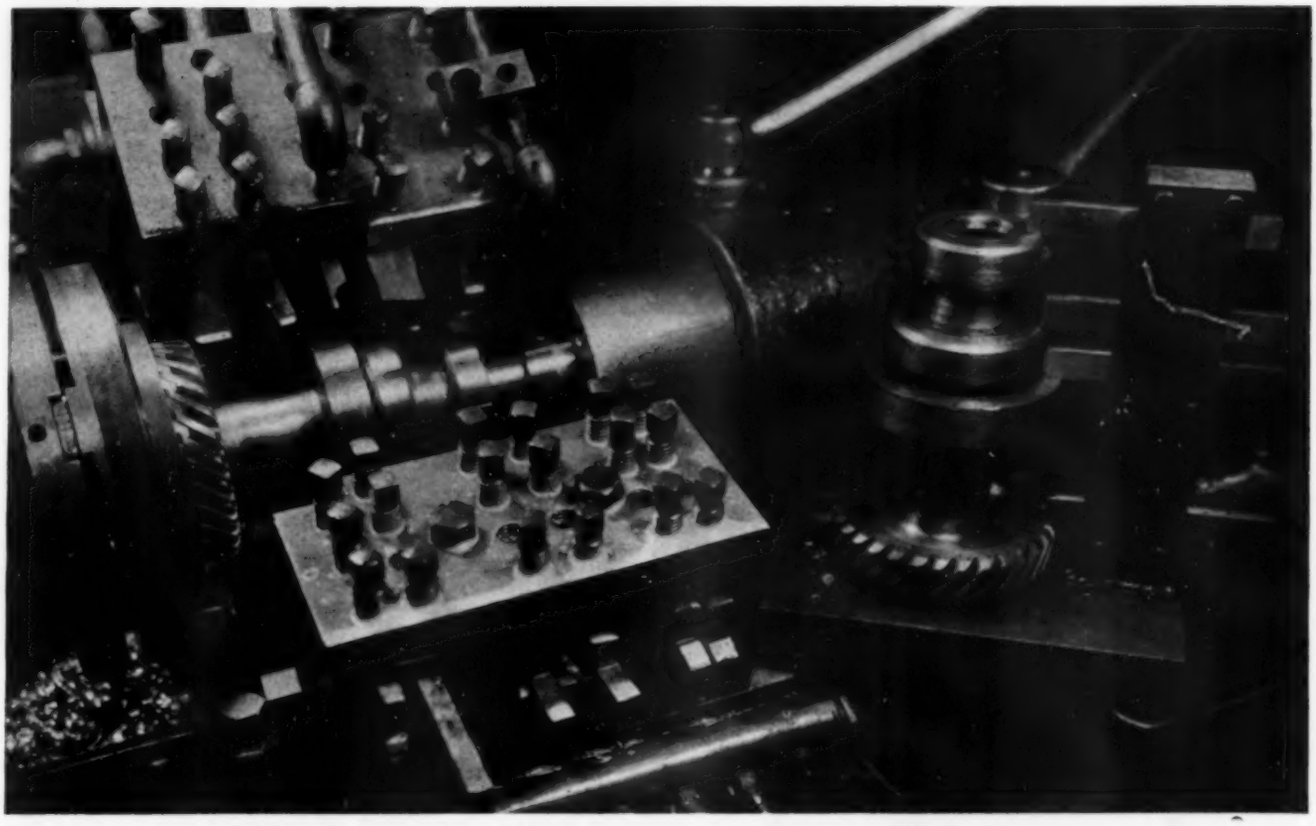
Two pieces are chucked at a time in a Jones & Lamson flat turret lathe, and after spot drilling and facing, are drilled with Celfor Type A drills. These tools are flat twist drills with small lands and large flutes which permit the soluble oil to reach the cutting edge and the chips to be flushed out. During this operation the largest gear is rough turned on the diameter, using a tantalum carbide tipped tool which avoids slowing down the work because of its relatively high surface speed at its outside diameter.

The ends of the cluster gears are then faced to length on an arbor in a Le Blond engine lathe. The only noteworthy feature of this operation is the quick-acting eccentric dog used to drive the work.

Both ends are chamfered to 40 deg. in an Aurora vertical drill to facilitate fitting the bronze bushings, which are assembled with the countershaft gear after hardening. Then the hole is sized in an Oilgear broaching machine for which a special three-section tool is used with 7 in. of rough cutting teeth, 7 in. of pilot and 7 in. of finishing teeth. This broach eliminates any possibility of drift in the bore.

To drive countershaft gears for turning, it is common practice to drill holes in the flange of the large gear. Besides requiring an extra operation these holes have a tendency to accentuate the distortion of the part during heat-treatment. At the Nash plant a method has been devised to drive the work from the teeth of the large gear. Accordingly the flange drilling operation is omitted entirely and at this point in the process, the teeth in the 30-tooth gear are rough cut on a No. 12 Barber Colman hobber.

The Fay lathes, in which the turning is done, are provided with special drivers which are essentially helical internal gears. With the cluster gear mounted



When turned in the Fay lathe the countershaft gear is driven from its rough cut teeth. For this operation the driver is turned down so the O.D. of the large gear can be finished. A welded gage which checks the steps in the cluster is at the right

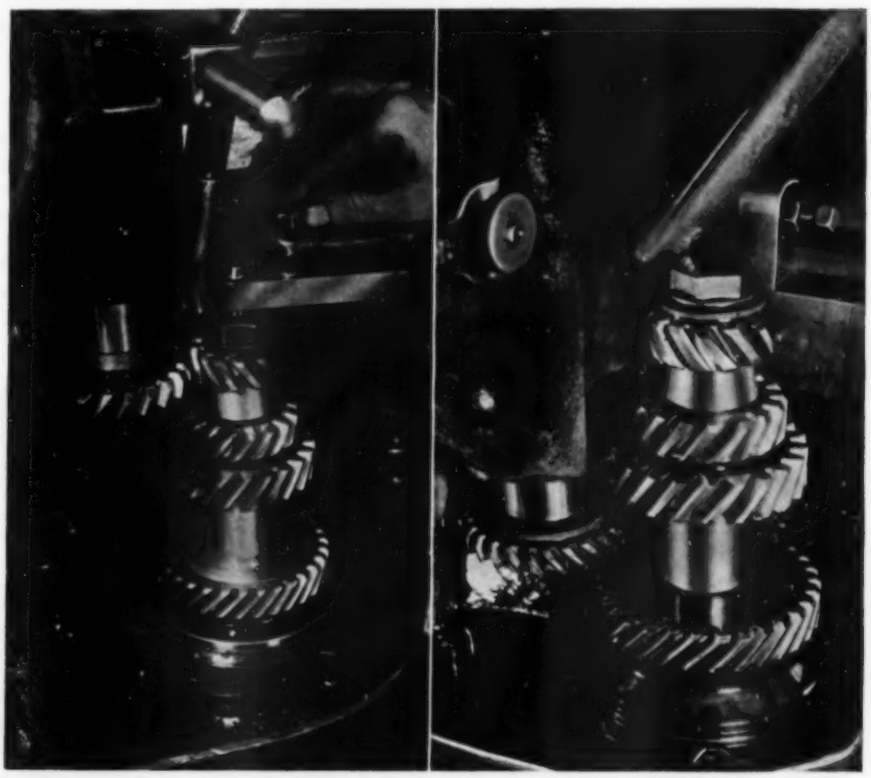
on stub arbors, the above mentioned internal gear gives an extremely substantial drive for the heavy cuts used in turning.

Three Fay lathe operations are used on the countershaft gears, namely, rough turn and face, recess the large end and finish turn and face. For the last cut the internal gear type of driver is reduced on the outside diameter leaving the teeth projecting which permits taking a finishing cut on the outside diameter of the 30-tooth gear while extending teeth of the driver engage in the tooth spaces. All Fay lathe operations are tooled with cobalt high speed steel.

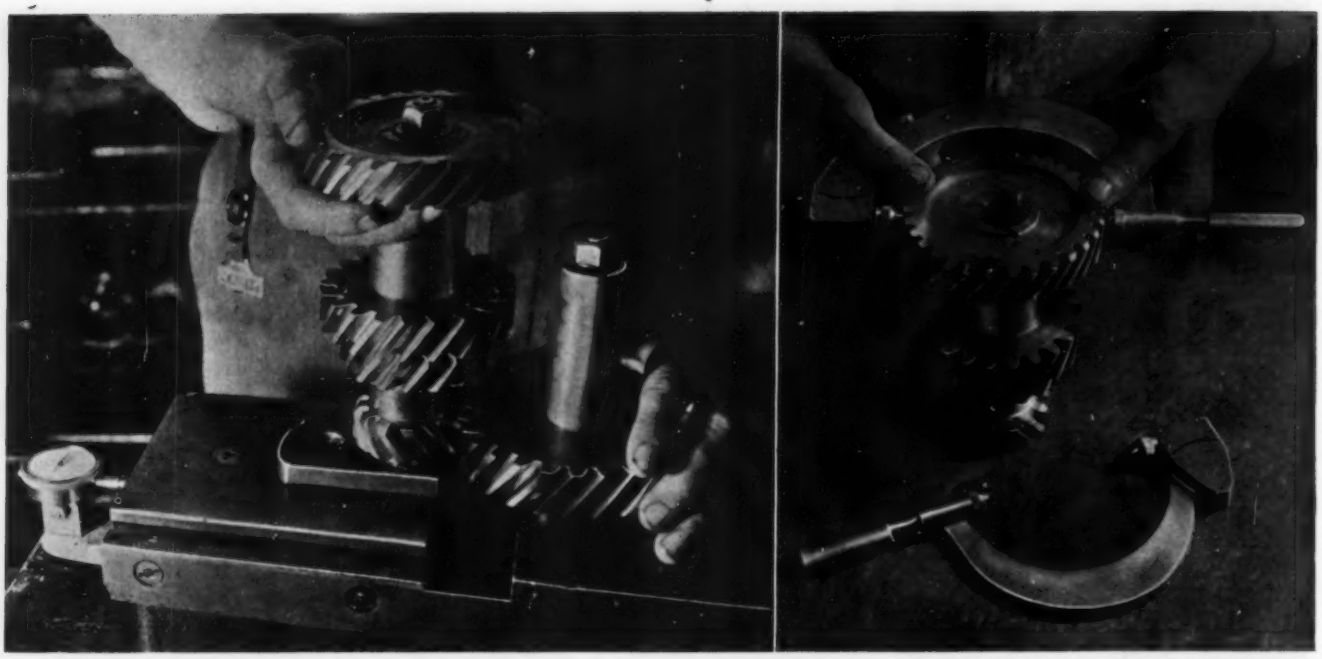
Adjustable snap gages serve to check the outside diameters, and a stand gage checks the location of the faces or steps in the cluster gear. These, of course, must be accurate to insure correct alignment with the meshing gears. In this connection it should be noted that all operations are inspected immediately after completion. Any inaccuracies caused by machine settings or tool wear can thus be corrected at once and the work kept within the specified limits at all times.

The 21- and 13-tooth gears are rough hobbed. The 16-tooth gear cannot be hobbed because of the small space between it and the 21-tooth gear.

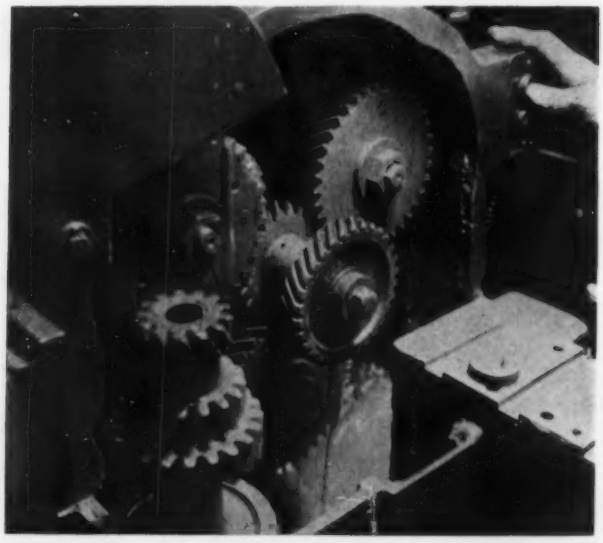
After drilling a $\frac{3}{16}$ in. oil hole, both



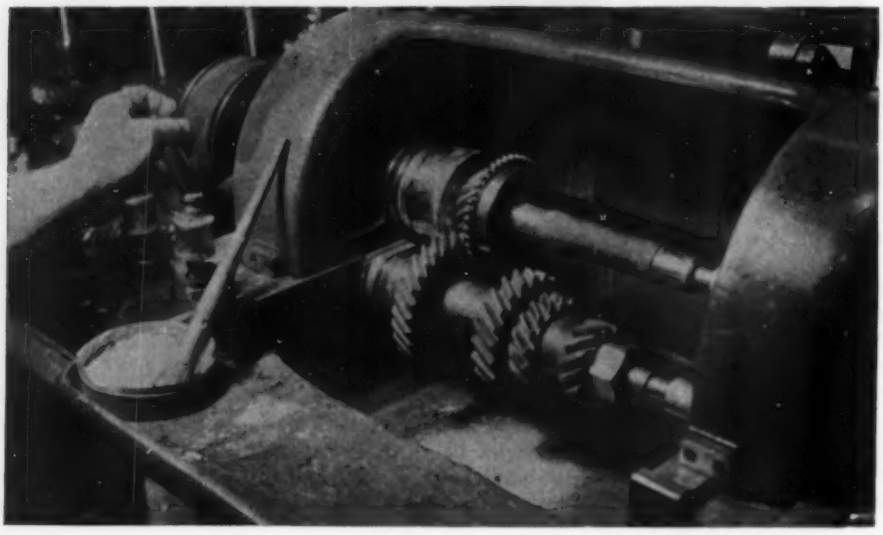
Two views of finish gear cutting in the Fellows gear shaper show the left-hand helix being machined on the 13-tooth gear and the right-hand helix on the 30-tooth gear. Two finishing cuts are taken in each case



Left—A runout gage provides a spot check on all gear cutting operations. Here the 13-tooth gear of the cluster is being rolled in mesh with a hardened master. Right—Another check on gear cutting is Nash's special gear micrometer which is used to inspect for correct pitch diameter



Smooth finish is obtained by lapping after hardening. The 21-tooth gear of the countershaft gear is shown here being finished on a Fellows three-lap recess type machine



An actual running test for noise and tooth contact is obtained on the National Broach & Machine Company's speeders. The countershaft and clutch shaft gears are being run together in the "silent" room

ends of the gear are milled with three small oil grooves tangent to the bore. For this operation the work is held in a three-position indexing fixture while a small circular cutter is fed downward by hand at each position.

The countershaft gear is then mounted on an arbor while the face of the 30-tooth gear is ground on a Landis machine. This operation insures that the finished cut teeth will be accurately in alignment with the bore. To make doubly certain of this the work is mounted on a test arbor and checked with a dial indicator before being passed to the next operation.

Next the 16-tooth gear is rough cut on a Fellows No. 75 high speed gear shaper using a three-cut cam. Then all four cluster gears are finish cut on similar machines with two-cut cams, that is, going twice around.

Gear Cutting Is Checked

Gear cutting is carefully checked first by meshing the gears with masters and rolling them on a slide in contact with a dial indicator to indicate any possible runout. The depth and thickness of the teeth are inspected by means of a special gage developed by Nash. This is essentially a micrometer provided with tapered swiveling contacts which fit between the helical teeth. For the 21- and 13-tooth gears it is necessary that a female contact point be used at one end to fit the outer faces of the odd tooth rather than a tooth space. These gages have a direct reading indicator point

which shows variations in dimensions to 0.0001 in.

The teeth of the 16-tooth gear are then rounded in a Peerless chamfering machine using a special fine point form milling cutter. This gear meshes with the low and reverse sliding gear and the chamfer facilitates engagement.

All cluster gears are then burnished by running them between hardened and ground masters in Fellows gear burnishing machines. Running under a predetermined load gives the tooth surfaces a dense highly finished surface.

The work is then ready for heat-treatment. Since all the other transmission forgings are of the same SAE 2350 steel they are heat-treated alike. Accordingly a description of the process for the countershaft will serve for all.

The parts are washed, inspected and then dipped in a 10 per cent muriatic acid solution. The acid dip insures thorough cleansing and prevents soft spots which might otherwise be caused by greasy surfaces.

Heating and Quenching

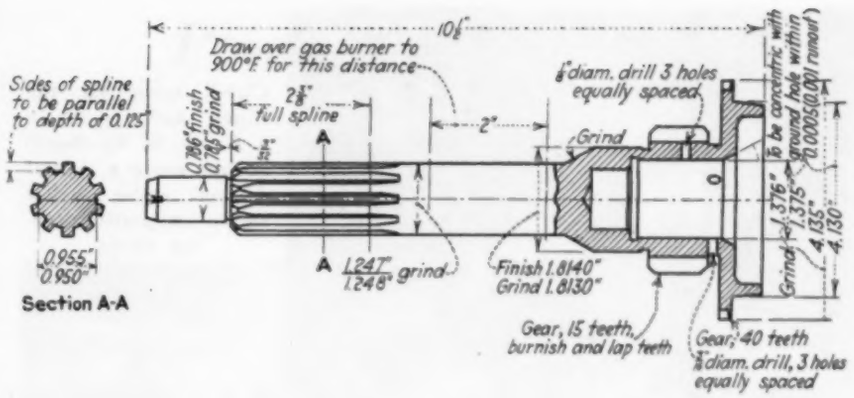
Heating is done in a rotary electric furnace at 1440-45 F. After removal from the furnace the parts are dipped in a cyanide pot for 15 to 20 seconds, held at the same temperature. They are oil quenched and drawn to 400 F. in a salt bath. The quenching oil is cooled and circulated. The cyanide dip increases surface hardness and facilitates cleaning. After wire brushing and spot polishing the heat treated parts are given a Scleroscope and Monotron hardness test.

Rolled bronze bushings on which shoulders have already been swaged are then pushed into both ends of the countershaft gear and are expanded in place by means of a push broach. These bushings are then diamond bored to size in a lathe by holding the work from the 30- and 13-tooth gears in a special chuck. The boring bar is piloted at both ends in a fixture which maintains accuracy within 0.0005 in.

Holding the work on an arbor the hub face at the large end of the gear is ground on a Landis internal grinder; then it is finished to length in a Heald surface grinder. The outside diameter of the 30-tooth gear is ground, and then all four gears are checked by rolling them with masters. This shows up any eccentricity or the presence of burrs which must be removed before lapping.

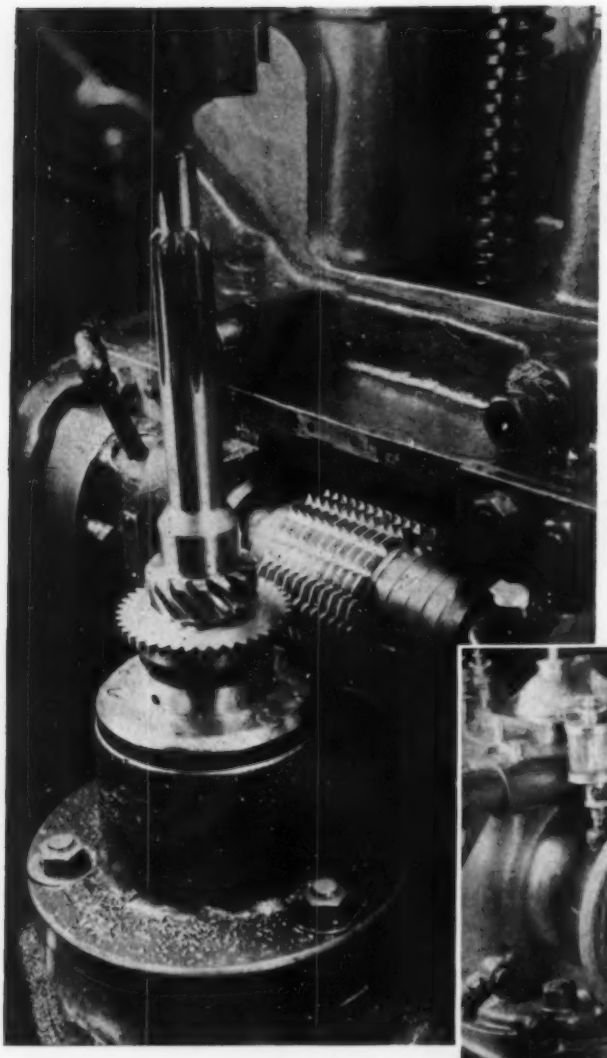
Each of the gears is separately lapped on Fellows recess type lapping machines. The work is rotated by a spindle while in contact with three master laps which are retarded by a brake setting up pressure between the gear teeth and the laps. As the work is revolved it is also reciprocated longitudinally and a fine commercial lapping compound pumped over it. According to a predetermined time cycle, which is automatically controlled by a limit switch, direction of rotation is reversed after a predetermined time to lap the opposite faces of the teeth. When the lapping cycle is completed the machine comes to a stop automatically.

After lapping and cleaning, all transmission gears are taken to a silent room which has double windows and whose walls are insulated with 2½ in. of cork. In this room are a number of National Broach gear speeders and a Fellows gear

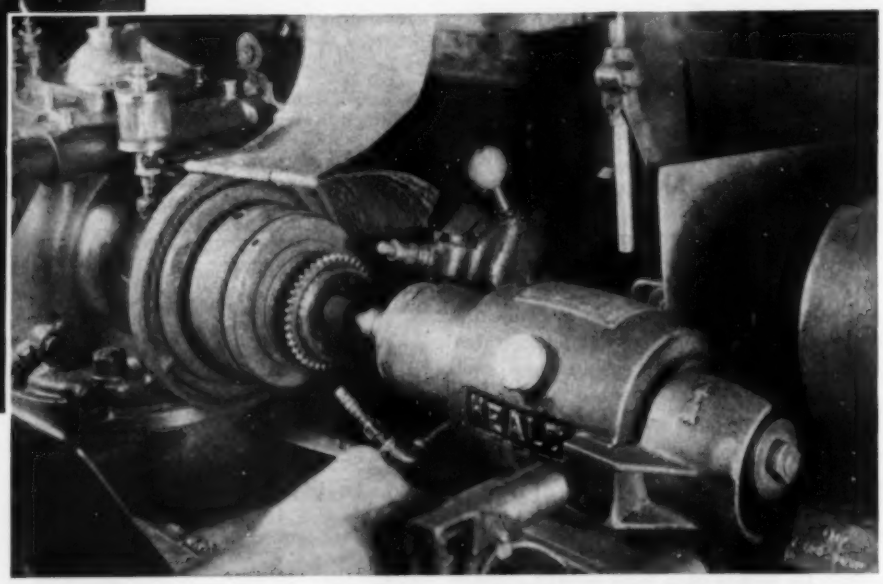


Clutch Shaft Operations

Operation	Machine
Mill to length	Davis Thompson milling machine
Center both ends	Hendey centering machine
Rough turn entire shaft to spur gear	Fay lathe
Finish turn entire shaft to spur gear	Fay lathe
Recenter small end	Leland Gifford drill
Core drill, bore, ream turn and face both sides of gear end	New Britain six-spindle automatic
Green grind small end	10x18 Norton grinder
Green grind stem	10x18 Norton grinder
Green grind bearing diameter and shoulder	10x18 Norton grinder
Grind gear diameter	Norton grinder
Finish bore, ream, and face bottom of hole, recess and recenter and finish turn O.D.	Warner & Swasey No 4 turret lathe
Grind face of clutch	Landis grinder
Hob 40-tooth gear	Gould & Eberhardt hobber
Hob spline	Barber Colman hobber
Chamfer spline	Barber Colman hobber
Rough cut 15-tooth gear	Fellows gear shaper
Finish cut 15-tooth gear	Fellows gear shaper
Chamfer 40-tooth gear	Lipe chamfering machine
Drill 3 ⅛ holes and 3 $\frac{7}{16}$ holes	Leland Gifford two-spindle drill
Wash	
Burr and file teeth	
Burnish	Fellows gear burnisher
Wash	Blakeslee washing machine
Inspect	
Harden and temper	
Wire brush	
Polish for Scleroscope and test	
Clean centers	Henry & Wright drill
Straighten	No. 4 Toledo press
Grind large center	No. 1½ Landis grinder
Grind small end	Norton grinder
Polish small end	
Grind 1.247-1.248 diam	Norton grinder
Grind 1.813-1.814 diam. and gear face	Norton grinder
Grinder taper for oil seal	No. 1½ Landis universal grinder
Grind 3.369 diam	Norton grinder
Rough grind 5-deg. taper	Norton grinder
Finish grind 5-deg. taper	Norton grinder
Grind hole in gear end	No. 72 Heald Sizematic
Wash	
Lap 15-tooth gear	Fellows outboard lapping machine
Wash in kerosene	
Inspect	
Speed test	



Clutch teeth on the clutch shaft are cut in a Gould & Eberhardt hobber using a special driving collar below and a supporting center above

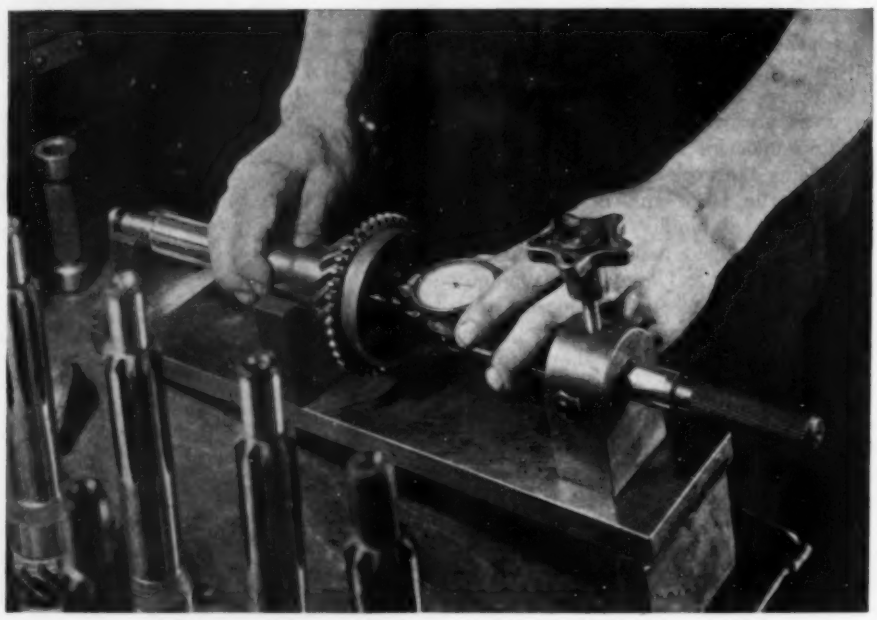


A Heald Sizematic finishes the hardened recess in the clutch shaft with the work supported by the two extreme outside diameters

testing machine. In the speeders all gears are given a running test for quietness in mountings designed to approximate closely conditions in the transmission case. Each set of gears is red leaded to indicate whether the proper tooth bearing is obtained. Gears that are run together are kept in their respective sets for assembly.

A certain number of gears are each day given a still further check on the Fellows gear measuring machine. Here the gear is mounted on a vertical arbor and tested for involute, lead, circular pitch, pitch diameter and eccentricity. Slight variations in machine settings can be detected by this device.

Both ends of the clutch shaft are milled to length simultaneously in a double-end, drum type, Davis-Thompson machine with the rough forgings held in place with a chain clamp. The forging is center drilled at both ends on a Hendey double-end centering machine using a special large center in the extruded recess in the gear end.



Although the grinding machine automatically holds the work to the correct size, Nash makes a double check by testing the hole in a special indicating fixture

Clutch-Shaft Operations

Like the countershaft gear, the clutch shaft is turned in Fay lathes with the work chucked first from the large end. A circular forming tool is used for the two chamfers on the small end, and the 3/32-in. grinding relief to keep these profiles accurate. The auxiliary tool block in the lathe holds the cutters for chamfering the corners of the teeth for the 15-tooth gear.

At this point in the process the work is recentered in a Leland-Gifford drill. With the multiple tool set-up used in the Fay lathes it is possible to exert sufficient pressure to distort the centers

somewhat despite the face that these machines are provided with ball bearing live centers. Nash takes the precaution of restoring the conical center surfaces to their 60-deg. included scale and original roundness.

A six-spindle New Britain chucking automatic then finishes the large end. This operation consists of core drilling, boring and reaming the hole, and turning and facing both sides of the gear end.

Face Trued for Gear Cutting

Outside diameters are green ground in Norton grinders in order to provide accurate locating diameters for gear cutting. With the work supported on two of these diameters, the recess is rebored square at the bottom and recentered in a No. 4 Warner & Swasey turret lathe. The work is then set up in a Landis machine to grind the end face providing true supporting surface when the teeth are cut.

First the 40-tooth gear is cut in a Gould and Eberhardt hobber. Then the spline at the smaller end is cut and chamfered in two set-ups in Barber Colman hobbers. The 15-tooth helical gear is roughed out and finished cut in a Fellows gear shaper. Tooth accuracy is checked by rolling with a master held against a dial indicator.

After the teeth have been rounded, three ⅛-in. and three 3/16-in. oil holes are drilled using simple indexing fixtures in a two-spindle Leland-Gifford machine.

The clutch shaft is then burred, burnished, cleaned and heat treated. These operations closely follow the procedure outlined for the countershaft gear except that the center portion of the clutch shaft is given an extra 900 F. draw over a gas burner to facilitate straightening.

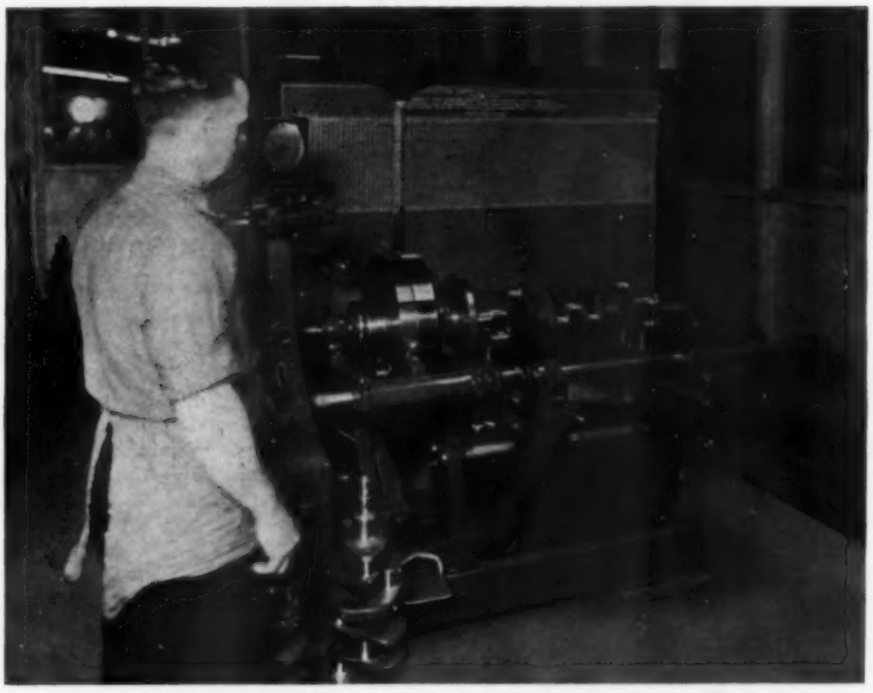
Following the usual hardness tests the clutch shaft centers are polished with emery cloth in a Henry & Wright sensitive drill and the piece is straightened in a Toledo press. With the work held from the pitch line of the gear teeth in a Cotta chuck, and the other end supported on a center the large center is ground in a No. 1½ Landis grinder.

Norton grinders finish the outside diameters with the work checked during the operation by means of Pratt gages. A Heald Sizematic grinds the recessed hole with the work supported from the two extreme outside shaft diameters.

The clutch shaft is lapped in a Fellows machine somewhat in the same way used for the countershaft gear but in this case an outboard support is provided. The work is driven by the clutch spline.

Part II of this article will appear in a later number.

Production Balancing at Hudson



One of a battery of ten machines illustrates Hudson's set-up for a 100 per cent dynamic balance of all crankshafts

Balancing of crankshafts has become increasingly important as the speeds of automobile engines have increased. Beginning with the old balancing ways of two hardened knife edges that were leveled, the need for running or dynamic balance was soon felt and various machines and methods were devised for the purpose, with widely varying degrees of success.

It was found, however, that while the accuracy of the balancing machine itself was of great importance, this alone did not tell the whole story. Much depended on the way in which the balancing machine was mounted and how it was used. Originally a laboratory instrument and used on a limited number of crankshafts selected at random, present practice has applied the balancing machine on the theory that every shaft has its own characteristics and must be balanced separately—and accurately.

In order to avoid errors caused by vibration of buildings, it is now customary to mount balancing machines on substantial foundations of their own. The Hudson Motor Car Company goes a step further and insulates the balancing machine from the surrounding earth.

There are ten Gisholt balancing machines in the Hudson line which check the running balance of every crankshaft. These ten machines are mounted on a huge block of concrete approximately 80x10 feet and 20 feet thick. Around this concrete block is a trench filled with cork to cushion or dampen any vibration from the earth around the concrete.

In addition, there is a glass inclosure around the whole block as can be seen. This partition makes it easy to maintain a constant temperature and to protect the balancing machines from dust or other foreign matter from the adjoining shop. As shown, the balancing machines are set crosswise of the concrete foundation.

Behind each machine is a large, easily read table that shows instantly how much metal must be removed from the various parts of the shaft to insure balance. After the dynamic balance is shown to be O.K., each crankshaft is checked on special, knife-edge ways, to be sure that it will remain in any position without rolling.

Die-Cast Parts for

JOHN M. BONBRIGHT

A BATTERY of thirteen die-casting machines, ranging in capacity from 90 to 960 pieces an hour each, and producing up to 30,000 pounds of finished castings in 24 hours, at the Bay City (Mich.) plant of the Chevrolet Motor Company, is used wherever possible for the economical production of large quantities of varied automotive parts requiring accuracy or a high degree of density, in combination with a fine surface finish.

Seven parts for 1934 Chevrolets, ranging from purely ornamental instrument panel moldings to strictly mechanical bearing retainers, are produced by die casting. Because of the record for economy and efficiency of die casting, and its advantages over other processes, it has been adopted for the making of two additional parts for the 1935 models.

Economy and accuracy are the two main factors governing the selection of die casting for the manufacture of parts by Chevrolet, provided of course that the characteristics of the metal—zinc base alloy—are suitable for the purposes for which the parts are designed. Economy is inherent because, as a rule, the die-cast part can be formed and finished without requiring various machining operations that would be necessary were any other method used. Accuracy is obtained not only through the precision of the steel dies, or molds, but also by the close control that may be exercised over casting pressures, temperatures of the metal and the dies, and the analysis of the alloy itself.

To attain the utmost efficiency and economy in die casting, the requirements of the process must be considered carefully in the original design of the part. The coordination and cooperation existing between the designing and production departments of Chevrolet guarantee the correct procedure. Those parts whose purposes permit them to be made of zinc alloy, and whose shapes may be adapted to die casting, are planned from the start to conform to the limitations of the casting machines and to gain the full advantages and economies of the process. Costly changes, which might involve modifications of other parts too, thus are avoided.

The carburetor air horn, with its projecting lugs and flanges, and its venturi tube on three slender legs, is an example of the complicated forms that can be cast in steel dies. The designing of molds that will duplicate the original pattern and then permit the removal of the casting from its solid steel matrix, is a highly specialized branch of the art of die cutting

Chevrolet makes its own dies at the Bay City plant. The cutting of dies for casting machines requires all the skill and care that are necessary in the making of patterns for poured castings in ordinary foundry practice, but involves also special problems that add greatly to the difficulties to be overcome.

To facilitate the removal of the casting is the principal consideration in planning the dies. All dies are made to allow for shrinkage of the metal in cooling; a uniform allowance of 0.005 of the size of the part is made. While this shrinkage promotes the withdrawal of castings by tending to free their outer surfaces from the mold, it has the opposite effect on the withdrawal of cores and internal portions of the dies from the castings. It is a general rule to provide draft or taper on all surfaces, both external and internal.

Another point emphasized by Chevrolet in its die making is to provide for the casting at each "shot" of as many single pieces as possible. This number is limited by the size of the part, of course, but also largely by its shape, which determines whether it requires cores that must be withdrawn at angles to the direction in which the two-part dies separate. The Chevrolet plant thus casts eight carburetor plunger caps at a single shot, 120 shots an hour, but only one head-lamp bracket (which requires a steel insert) at a shot, 90 an hour.

Die-makers require from six weeks to two months to complete a set of dies. In use, the dies are not subject to any appreciable deterioration. Actually, they improve at first, producing a better surface on the casting after the dies have been in use long enough to acquire the glazing of the surfaces caused by repeated heatings. On the other hand, the frequent alternate heating and cooling of the surfaces in time produces slight surface checks in the cavity; their effect, however, is of no detriment to castings that are to be used without surface finishing, and is readily removed

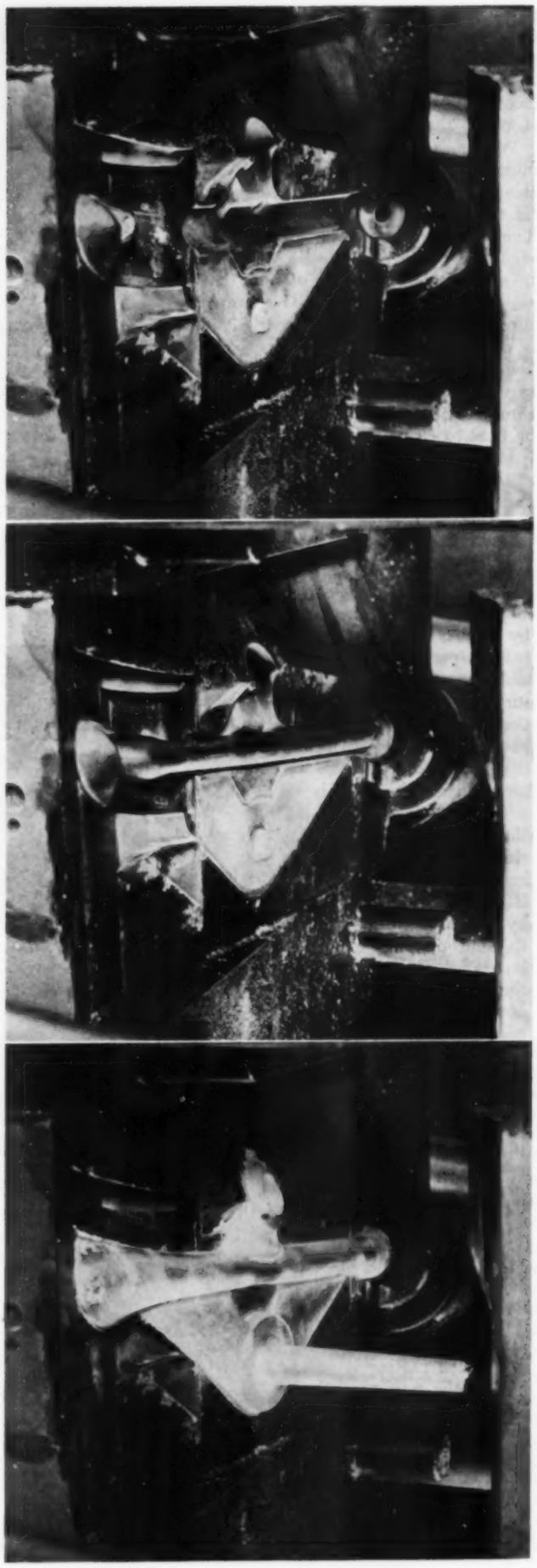
Chevrolet

Die-Castings Made for the 1935 Chevrolet

Part	Finishing Operations
Instrument panel molding	Trimmed, polished and plated
Headlamp bracket (R & L)	Trimmed, polished and plated
Transmission fulcrum-ball seat	Trimmed only
Transmission bearing retainer	Trimmed and tapped
Carburetor air horn	Trimmed, drilled and faced
Carburetor-bowl cover	Trimmed, drilled and faced
Carburetor plunger cap	Trimmed only
Radiator ornament	Trimmed, polished and plated
Tail lamp and license bracket	Trimmed, drilled and tapped, enameled

by the polishing operations from parts that are destined to be plated.

Long experience backed up by painstaking research and experiment enables the Bay City plant to cope successfully with one of the most problematical points in die designing, that is, the proper locating of the gates through which the molten metal is forced into the mold. A faultily designed or misplaced gate will produce an imperfect casting, since the first metal to enter may set and prevent parts of the mold from filling. Even now, if duplicate dies are to be made for use on more than one casting machine, or if a single die is to turn out multiple castings, only one set or one unit of the multiple mold is first gated and tested. Trial castings may show the need for relocating or altering the size of the gates. In that case, a series of castings is made in which each one receives a gradually increased quantity of metal. The incomplete castings obtained by using this method reveal which



Chevrolet's headlight bracket is selected as an example of the sequence of steps in die casting because it illustrates the use of a steel insert which runs the full length of the bracket. This insert provides the required strength; the jacket of zinc alloy which is cast around the steel provides a superior surface for economical and efficient chromium plating

***Top*—The stationary half of the die is shown before the steel insert is placed in position; the movable half of the die is at the right. At the bottom of the fixed die are the heavy dowel pins that align the two halves. Note that the annular end of the core, by which the steel insert is located, is retracted in the die. The heavy steel rods at the top and bottom are respectively one of four that draw the movable half of the die against the fixed half and one of the two that pull the casting head of the machine against the dies to form a close contact between the metal nozzle and the opening of the mold**

***Center*—The steel insert is preheated and locked in place. The core at the far end now protrudes into the mold, holding the thread end of the insert and accurately locating the insert in the cavity**

***Bottom*—The casting remains in the fixed die as the movable die is withdrawn. The sprue, projecting forward, is left on the casting between the metal-nozzle and the mold. This view also shows the layout of the gates by which the metal enters the matrix. The left end of the casting is formed by the vertically movable sections of the dies, pushed into place mechanically as the dies are brought together**

parts of the mold are the first to be filled and to which parts the metal flows last. The need for added or relocated air vents also may be shown by these incomplete shots, which are obtained by stopping the stroke at different stages.

With new dies, tests are run to determine the best temperature at which they should be maintained and the correct time to allow for the casting to cool. The temperature of the alloy itself is regulated by thermo-couples which electrically regulate the flow of fuel (natural gas) to the burners. The temperature of the dies for the heavier castings is controlled by water-cooling, the dies being bored out to form water passages; by regulating the rate of flow through the dies their temperature may be held to close limits.

In general, melting pot temperature at the Chevrolet plant runs between 780 and 810 F.; dies operate at temperatures close to 350 F. The essential requirement is that the molds shall be kept hot enough to prevent any of the metal from setting before the entire mold is filled. (Preheating of the molds by gas burners is necessary in starting.)

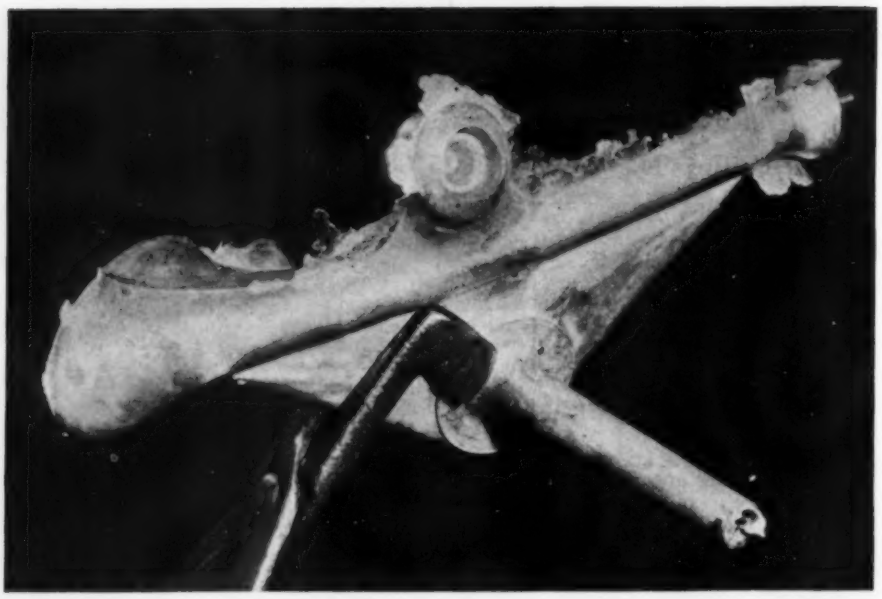
High pressures are used to force the molten metal into the mold, both to insure filling of the space before any of the metal can cool sufficiently to set, and to produce castings of maximum density. The pressure on the liquid metal inside the mold is set at 1200 lb. per sq.in. The metal is forced from the bottom of the melting pot by a solid steel plunger 2¾ in. in diameter, working in a vertical cylinder. The plunger is pushed down through an 8-in. stroke by a pneumatic piston under 90 to 100 lb. line pressure. Since the first few inches of plunger travel fill the mold, the metal is held during the remainder of the stroke under heavy pressure built up as the molten metal in the cylinder is forced to pass between the plunger and the cylinder wall. The plunger then is allowed to remain at the bottom of its stroke, maintaining the pressure during the time allowed for the casting to set—30 sec. in the case of the heavier castings having thick sections.

All the casting machines at the Chevrolet Bay City plant are AC automatics. Each requires but a single operator, except when a preheated insert is to be placed in the die before the cast is made; then the heater acts as helper. Three cycles a minute are possible, provided the casting is sufficiently light to set in the minimum time.

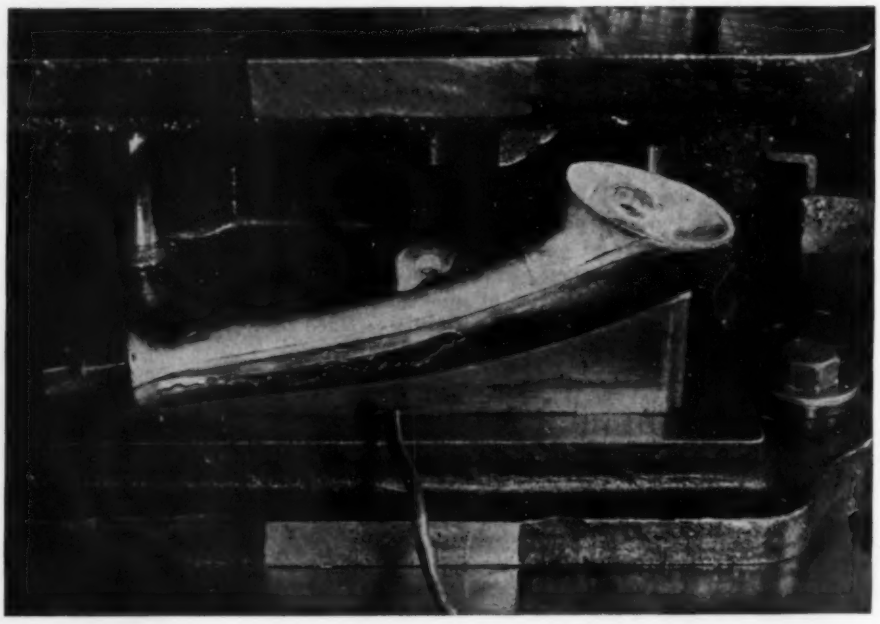
The two halves of the mold are mounted with their faces vertical, to be brought together by the horizontal motion of the machine. Briefly, the cycle of operations is as follows:

In operation, one part of the mold remains stationary; as the machine starts, the opposite part is brought in firm contact with it, accurately guided by dowels, and held under heavy pressure by toggle action. At the same time, the permanent steel cores or movable parts of the dies that are operated at angles are projected into the molding space either by hand-levers or by toggle or cam action. After the faces of the dies are in contact, the head of the machine, carrying the melting pot, is moved to bring the rounded end of the nozzle leading from the cylinder under high pressure against a spherical aperture in the back of the movable die.

Before the plunger begins its stroke, the two halves of the die, and the nozzle end and the opening into the mold, are tightly squeezed together, since the machine completes its stroke against the



As the casting comes from the machine, the operator breaks off the hot sprue and returns it to the melting pot immediately, to avoid the fuel waste that would be caused by replenishing the pot with cold metal



Castings are placed in dies for trimming off the excess metal in a press. This bottom view of the Chevrolet head-lamp bracket shows the circular marks on the casting made by the ends of the ejectors in the mold. The threaded end of the steel insert is seen at the left

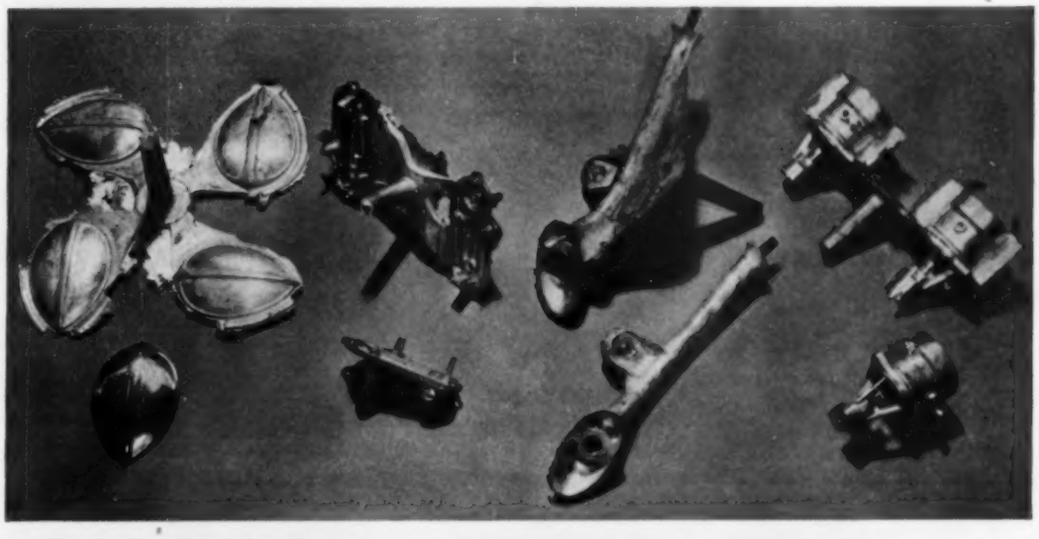
heavy compression of rubber blocks. After the metal is forced into the mold, time is allowed for the casting to set. The machine then operates in reverse sequence. As the dies separate, the casting remains in the stationary mold. The tapering sprue, or metal solidified in the gate between the nozzle and the casting, is left as a horizontal projection on the casting. The operator seizes the sprue in his tongs, and by operating a hand-lever actuates ejector pins running through the die to push the casting free.

Instead of leaving the sprue to be removed later in the course of the trimming operations, the machine operator, immediately after the casting is removed, breaks off the sprue and returns it to the melting pot. Since the sprues are still at a comparatively high temperature, and contain a large bulk of metal, this system effects a considerable saving in fuel.

Chevrolet uses the same zinc base alloy in all its die-cast parts. However, in casting parts that are to be polished and plated, only new metal as received from the suppliers is used. Reclaimed metal, which includes the fins trimmed from the castings and the spatterings from around the machines, is used for parts that are not to receive a fine surface finish.

From the casting machines the parts go to the trimming operation. Mechanical parts are trimmed only, except that holes which cannot be made in the casting by cores are machine-drilled. Parts to be plated are first polished. Nickel-plating is applied directly to the alloy, then polished; the chromium-plating is then applied.

The most difficult and complicated die used at the Bay City plant is that which produces the carburetor air horn. Not only is this part of complex shape, but it requires a higher degree of accuracy than any of the other parts, since the openings formed in it comprise two sections of the triple venturi tube into which the gasoline is drawn from the fuel nozzle. To provide uniform engine performance, requiring an even flow of correctionly proportioned and finely atomized fuel, these openings must be accurate to 0.0002 in.

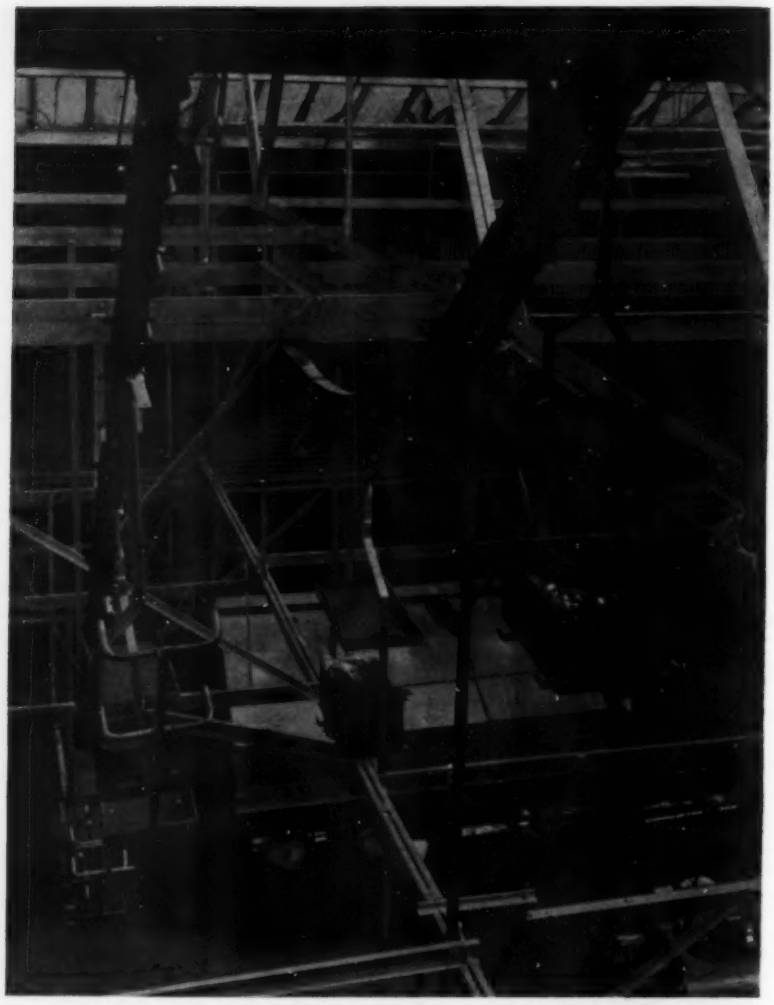


Four radiator caps, two carburetor-bowl covers, one head-lamp bracket and two carburetor air horns are shown as removed from the molds as single castings. Below each rough casting is shown one of the parts as trimmed or partly finished

The die-casting machine operator is holding the preheated steel insert in place with tongs, and is about to move the lever that locks the insert in place. The movable head of the machine carries the melting pot and the pneumatic cylinder and plunger that force the metal into the mold under a pressure of 1,200 lb. per sq.in. From the pot runs the wire for the thermo-couple that regulates the feed of natural gas, to control the temperature of the molten metal

Packard's Set-Up for Chromium Plating

Continuous automatic and still tank equipment is described for copper, nickel and chromium plating



Work enters the plating department on a continuous chain conveyor. The inspection booth may be seen below

NEXT to reliable mechanical performance, attractive appearance is the quality most sought by the users of modern automobiles. In the fine car field this requirement is doubly important because the buyer demands a car that he can be proud to own in addition to giving him trouble-free transportation. The finish on a car of this kind must be as enduring as the operating mechanism.

Chromium plate has played an important rôle in the dressing up process during the past few years. Its brilliance sets off and accentuates the deeper tones of colored lacquer, and this contrast is preserved by its freedom from tarnish and its high degree of hardness which resists abrasion. But to possess these qualities and maintain its beauty chromium plate must be expertly applied.

In recognition of the important place this process holds in automotive manufacture, the Packard Motor Car Company last summer rearranged its plating department and allotted it greater space. Noteworthy features of the revised set-up are the cleanliness both of atmosphere and equipment and the efficient means provided for material handling.

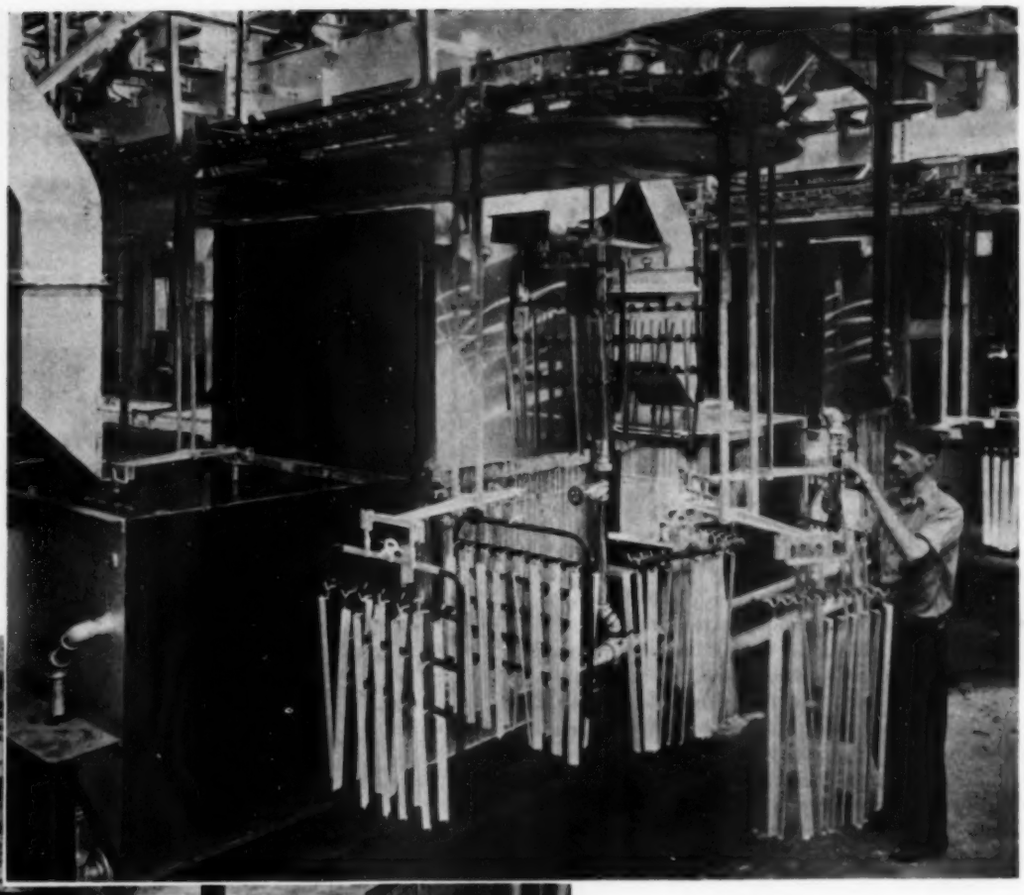
A system of floor drains flanking all tanks on both sides keeps the floor free from cleaning and plating solutions. These drains are covered by gratings set flush with the floor allowing free movement of men and work without forming an accident hazard.

A complete exhaust ventilating system keeps the atmosphere clear of fumes from the plating tanks and dust from the buffing wheels. Tanks subject to gassing have exhaust ducts close to their surfaces, and each buffing wheel is covered with an individual hood. A good idea of the ventilating facilities may be obtained from the accompanying illustration.

Conveyor System

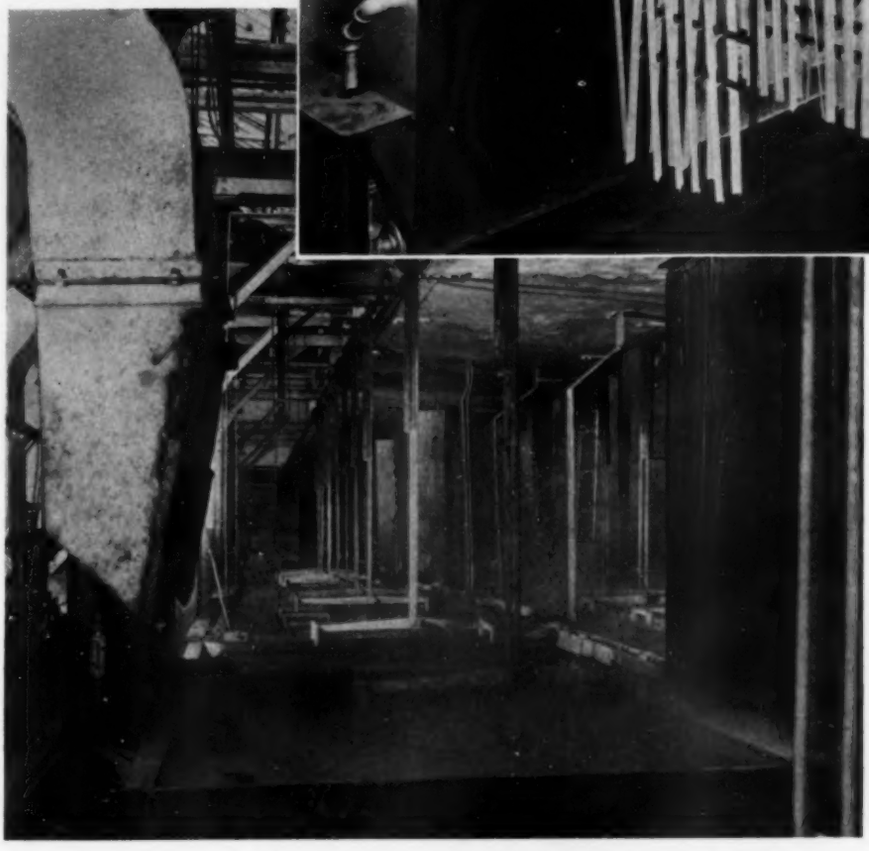
The material handling equipment consists of three chain conveyors, one of which serves the copper plating tank, another the nickel plating tank and a third which encircles the entire department. The speed of the continuous tank conveyors is controlled by means of Reeves variable speed drives. The third conveyor brings work from the floor above the plating department and carries it past the copper plating tank, past the buffing wheels and nickel plating tank and then loops over itself carrying the parts around the chromium plating platform and back to the inspection booth.

Plating of decorative pieces at Packard consists in copper plating, nickel plating and finally chromium plating. All three processes are needed for fine work. Chromium alone cannot be commercially built up into a heavy protective coating because of its tendency to crack. Chromium's function is to give color, wear and tarnish resistance to the finished part and is applied only in sufficient thickness to cover those requirements. Nickel is an ideal coating for rust prevention and for years was used as the only outer coat for plated automotive parts. Its tendency to tarnish and turn



Racks are loaded at the entering end of the automatic copper plating unit. Note the mechanism for lifting the work from one tank to the next

A view of the nickel plating tank gives an idea of the distance the parts travel during this operation



yellow, however, brought about the addition of chromium as the final plate.

Nickel can be plated directly upon steel but not nearly as well upon copper. If steel is nickel plated without an undercoat of copper, rust resistance will usually be lowered. In some plants merely a "strike" or "flash" of copper is used for this purpose, but at Packard an appreciable thickness is employed to form a good foundation for the nickel and to give added protection.

One of the secrets of successful plating is the proper preparation of the parts. The Packard polishing department occupies the floor above the plating department and, like it, is provided with a complete exhaust system. Prominent parts, such as radiator shells, are given as many as five separate polishing operations using a different abrasive for each one. The first polish uses a rather coarse wheel to remove completely all film and scale. Then finer grained wheels are used successively to remove the polishing marks left by the first operation; the direction of polishing is alternated with each succeeding wheel. A mirror-like surface results which shines as though it had already been plated. Smaller parts and those not visible on the outside of the car are polished in a similar manner but fewer operations are used.

The work is then placed on the conveyor which carries it into the plating department proper. Smaller parts are carried in groups by means of specially designed racks. At Packard the question of racking has received considerable attention because it is highly important to hold the work securely and at the same time to permit quick mounting and removal. Each new design of rack is approved by the plating department foreman and the laboratory supervisor before final acceptance.

Both copper and nickel plating is done by the continuous automatic process. The work is carried through the various cleaning and plating tanks on conveyors which are provided with special cams for raising the work racks as they pass from one tank to the next.

As the work comes from the polishing room it is removed from the main conveyor and transferred to that for the copper plating bath. The parts first pass

through a hot spray of alkaline solution to remove dirt and grit remaining from the polishing wheels. They then pass through two electric cleaning tanks first with the work connected as the cathode and next as the anode. The solution, which is held at about 180 F., is prepared from commercial cleaning compounds. The change of polarity first causes generation of gas on the work allowing the cleaning reagents to scour the surface; then the use of the work as anode throws off any impurities that might be present in the solution.

The work is carried through a rinsing spray and then dipped into a ten per cent hydrochloric acid solution. Another spray and rinse follow. Immersion in a sodium cyanide bath immediately before plating (3 oz. of salt to a gallon of water) removes any stains that might be left on the metal.

Copper cyanide solution with copper anodes is used for copper plating. The work is carried through this tank for 10 minutes with a minimum current density of 25 amps. per sq.ft. It is then rinsed, first in cold and then in hot water to dry it quickly.

Continuous Nickel Plating

For most work the copper plate is not buffed, but on a few large and conspicuous parts this operation is performed. The copper plated parts are then transferred to the nickel plating conveyor where they are put through a series of washing and cleaning operations similar to those described for the copper plating process. Before reaching the nickel solution the work is given a copper strike, that is, a light additional plate. Two rinses follow and then the work passes through a nickel sulphate solution for 30 min. As for copper plating, a minimum current density of 25 amps, per sq.ft. is maintained. A cold and a hot rinse free the work from plating solution.

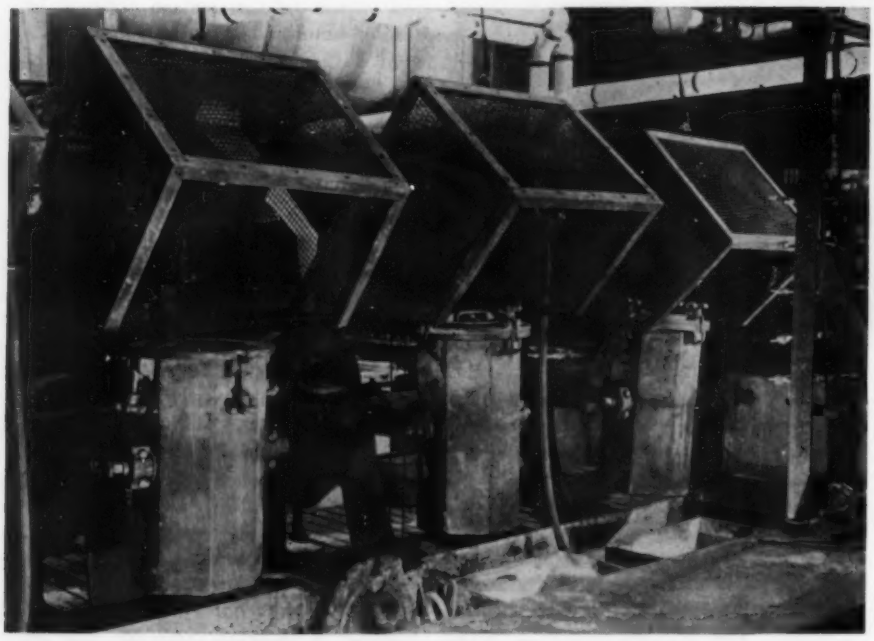
All parts are buffed after nickel plating. Gardner buffing stands are used with rag wheels or wire brushes. Commercial buffing compounds, composed chiefly of wax and mild abrasives, such as rouge, are applied to the rag wheels.

Small parts, such as washers, are burnished instead of being buffed. This is done in Baird burnishing barrels in which the work is rotated with steel shot and soap chips. Parts with threads or fine edges are not handled in this way.

From the buffing stands the conveyor carries the work to the chromium plating section. Here the still tank method is employed with the work immersed and removed from the tanks by hand. This is preferred to the continuous plating process because of the variety of anodes that must be used.

In considering chromium plating it must be recognized that the throwing power of chromium is far below that of copper or nickel. To correct this difficulty conforming anodes are used. These follow the shape of the work and thus keep the amount of solution between the work and the anode approximately uniform. If, for instance, the inside of a ring is to be plated it is necessary to pass an anode through it.

Parts are buffed after nickel plating to give a highly finished surface for the application of chromium

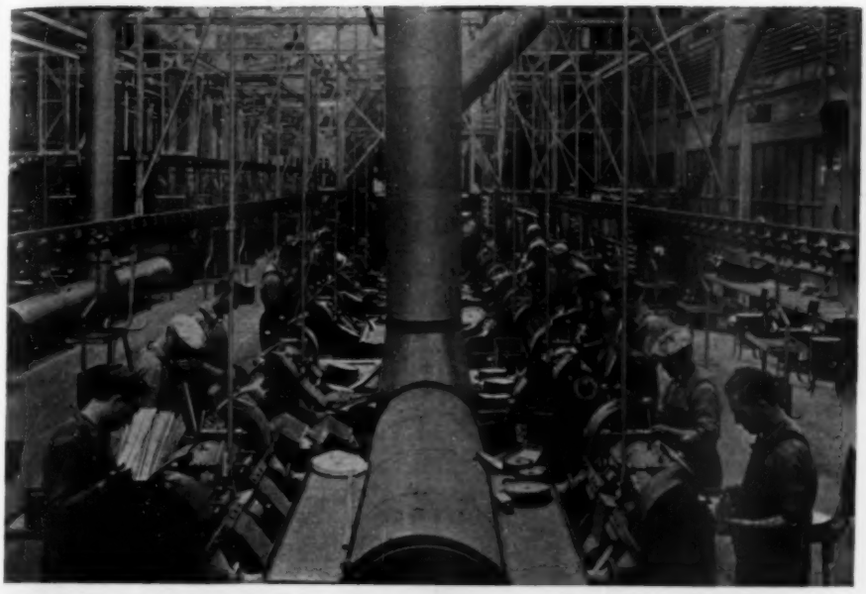


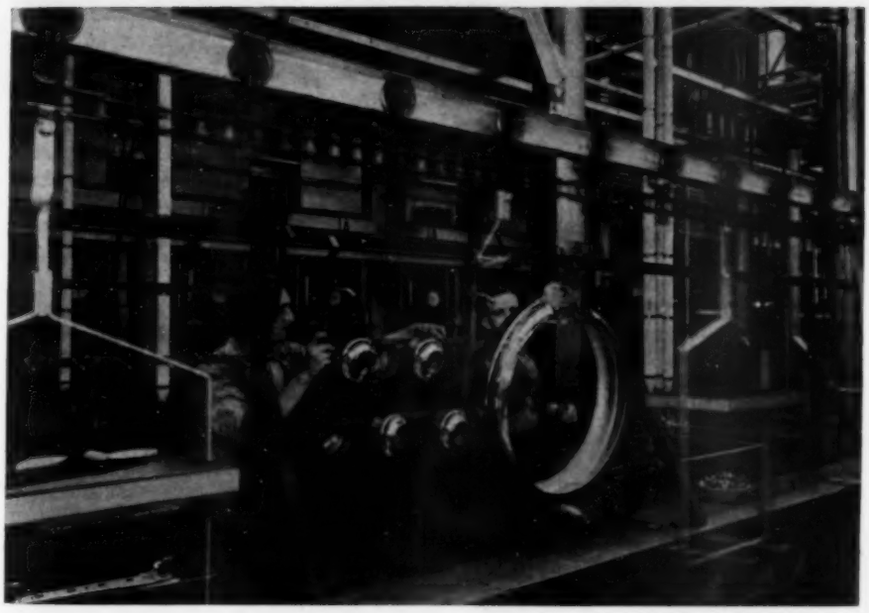
Small parts are burnished by being rotated in these barrels with steel shot and soap chips

Radiator shells, and other irregularly shaped parts, must be plated with anodes that are specially designed to follow their contours. Thus it is necessary to have a number of separate plating tanks for different types of work.

The active part of the plating bath is chromic acid formed by dissolving chromium anhydride, a chrystalline salt. The anodes and plating tanks are made of 6 per cent tin-lead.

Preparatory cleaning baths are much the same as those used in plating copper and nickel except that the work is immersed in them by hand instead of by automatic conveyor. After rinsing the work is put into an electric cleaning solution, rinsed again and then dipped into dilute hydrochloric acid. Another rinse and the work is ready for the plating tank where it is immersed from three to five minutes depending on its





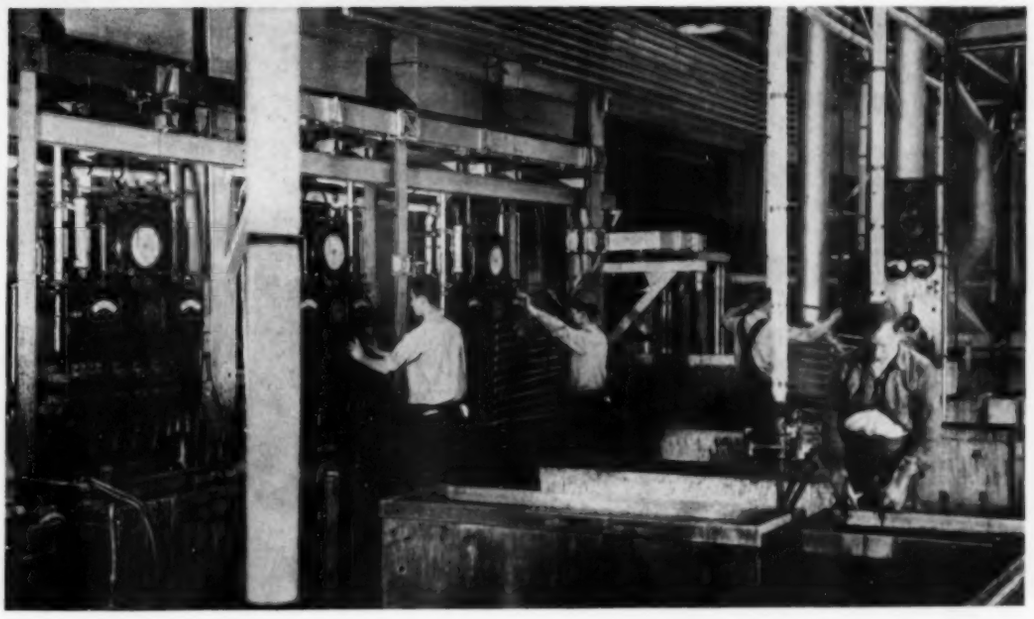
size, shape and position on the car. It has been found from experience that this length of time in the chromium plating bath gives ample coverage without the danger of checking or cracking likely with a heavier plate.

After plating the work is transferred to the "drag-out" tank where it is rinsed; the contents of this tank are used to replenish the plating tank solutions, thus recovering most of the chromic acid which adheres to the work. A cold and a hot rinse follow which complete the operations in this process. The work racks are returned to the conveyor and carried away for inspection.

Ordinarily no buffing is done after chromium plating. Occasionally the corners of certain parts may be touched with the wheel to smooth them off but this is done in such a way that no buffing marks will appear on the finished product.

Zinc die castings while following the general procedure used for steel parts need special treatment. Plating solutions have a tendency to attack die cast material before the plate is deposited. If the zinc dissolves the plated coat becomes discolored and spongy. To avoid this, special baths are employed for plating with both copper and nickel. The conductivity of these baths is increased by the addition of salts; for example, a high sulphate nickel solution is obtained by the addition of sodium sulphate. After the nickel plating the parts can be plated in the regular chromium plating baths as the die cast metal is then completely protected.

Plating time is greater for die cast parts than for steel; 20 minutes is used in the copper tank and 35 minutes in the nickel. This section uses still tanks rather than automatic plating units.



Top—A general view of the buffing section gives an excellent idea of the exhaust and conveyor systems

Center—Parts leave the chromium plating department on a conveyor; note the careful design of the work racks

Bottom—Time and current densities are controlled with the aid of instrument panels placed directly over the chromium plating tanks

A special section is provided for the copper and nickel plating of zinc base die casting because of the tendency of the solution to attack this material

After washing, the parts are held in the solution on rods running lengthwise over the tanks. These rods are mechanically reciprocated to insure proper agitation of the work in the bath. Over each tank a clock is placed to give an accurate check on the plating cycle.

Except for miscellaneous pieces of equipment such as the stripping tank, this completes the description of Packard's plating facilities. Parts which do not fully meet rigid inspection requirements, whether plated outside or in the Packard plant, are stripped in this tank.

Packard specifications for plating over steel call for 0.5 oz. (or 14.17 grams) of copper and nickel per sq.ft. of plated surface; 3 grams of copper to 11 grams of nickel is the preferred ratio, or about 0.1 oz. of copper to 0.4 oz. of nickel. Chromium is applied to a thickness of 0.0053 oz. per sq.ft.

On die cast parts at least 0.141 oz. (or 4 grams) of copper and 0.35 oz. (or 10 grams) of nickel are required on buffed surfaces. The chromium plate specification is the same for steel parts.

Formerly adherence to these thicknesses of plate specifications was checked by cutting a 2-in. square of plated stock, grinding it carefully to size and then determining the amount of deposited metal by quantitative chemical analysis. This method has been supplanted by measurement with a Bausch & Lomb micrometer which reads directly the thickness of the plate. From this reading the weight of deposited metal may be quickly obtained since 0.001 in. of coating weighs approximately 20.8 grams.

After the work has been chromium plated it is carried on the conveyor to the inspection department. To facilitate visual inspection, a booth is used which is flooded with indirect white light. Under ordinary daylight it is difficult to distinguish between freshly plated nickel and chromium. However, if a part has insufficient chromium to hide the nickel the under plating will show up in time. Under the special inspection booth all high lights are avoided, and if any nickel shows, it can be readily distinguished by a distinct yellowish tinge.

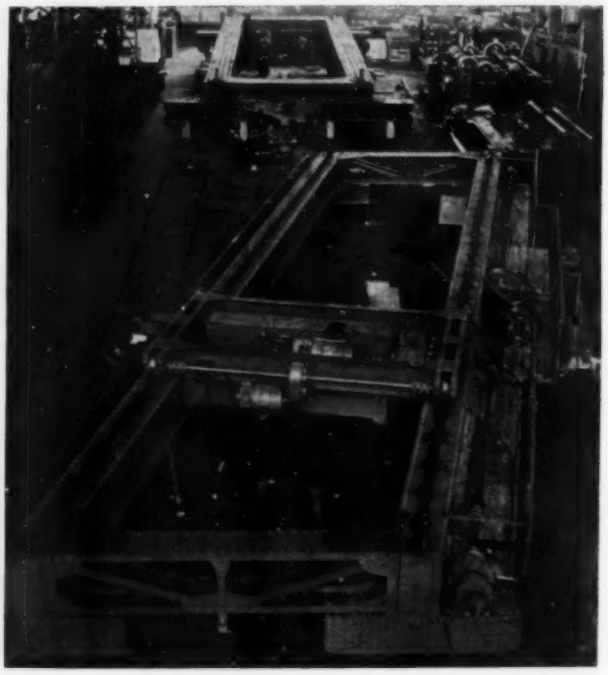
Methods of plating are supervised by the Packard laboratory in which is located an experimental plating layout. In this miniature plating department the effect of various solutions and current densities is tested. A salt spray is also provided which serves as an additional test of the quality of Packard plating.

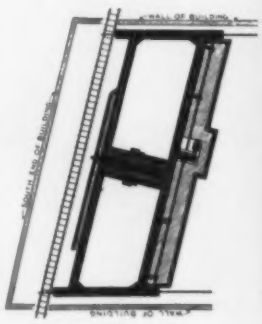
A Skew Crane for Fisher Body

Because of the odd shape of the south end of Plant 37 of the Fisher Body Company, at Detroit, to accommodate a railway siding, a crane was recently installed that travels on its runways at an angle of 77 deg. This matches the angle of the south wall and enables the crane to load and unload dies, presses and sheet stock from cars throughout the entire building. Headroom is 7 ft.

The unit, a 50-ton P. & H., has a span of 67 ft.; the driving mechanism, truck gears and pinions have miter teeth for traversing the bridge. A low overhead or submerged type trolley is used.

To the right is the skew crane in the process of assembly at the Harnischfeger plant. Below is a plan view of the installation



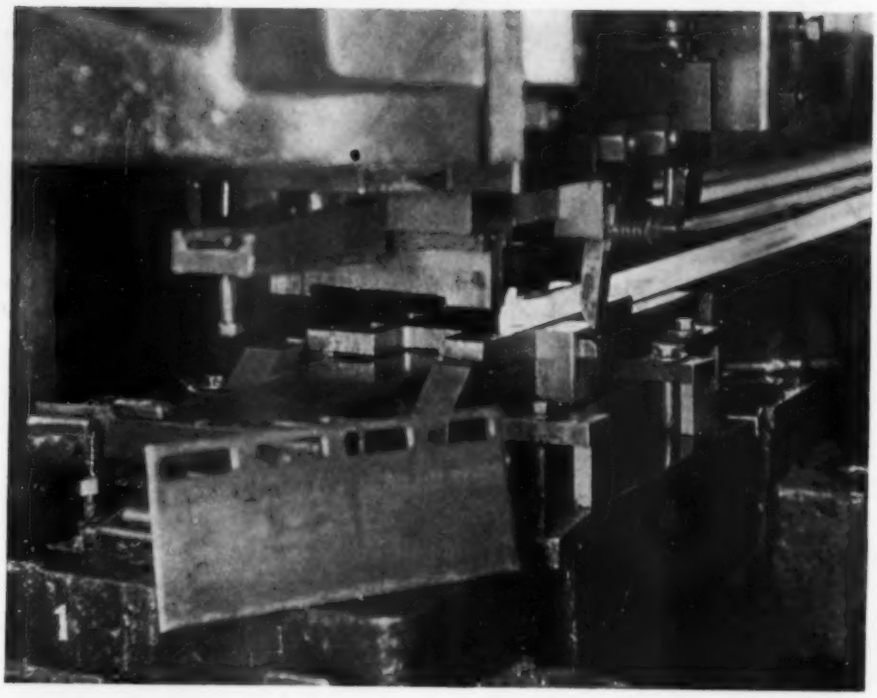


Starters and Generators in Process

AMONG the important accessories that the automobile driver seldom appreciates because they rarely make themselves known by giving trouble, are the generator and starting motor of the modern car. A few drops of oil when the driver thinks of it, or left to the tender mercies of the service station, and the generator keeps the battery charged. The starting motor stays on the job despite the severe service it is called upon to perform in turning over heavy engines in cold weather. Few realize the care that goes into the making of this apparatus, or the care that has been given to improving quality and reducing costs at the same time.

Some of the features, which have helped to make the Autolite starter one of the best known, are shown herewith through the courtesy of that company and its executives. Only a few of the operations can be shown in a single article, and so the frame and some of the operations on the armature have been selected for that purpose.

The frame is made of strip steel plate, or skelp, about $\frac{3}{8}$ in. thick and of width equal to the length plus metal for finishing the ends. The material comes in by conveyor direct to the press which cuts it from the strip, and at the same time, punches four rectangular holes along one side as in Fig. 1. From here the punched blank goes to the adjoining press where the bending operation is performed. The three operations are performed in the press progressively—a finished piece drifts off the press at each stroke. The manner in which the three bends are made can be seen in Fig.



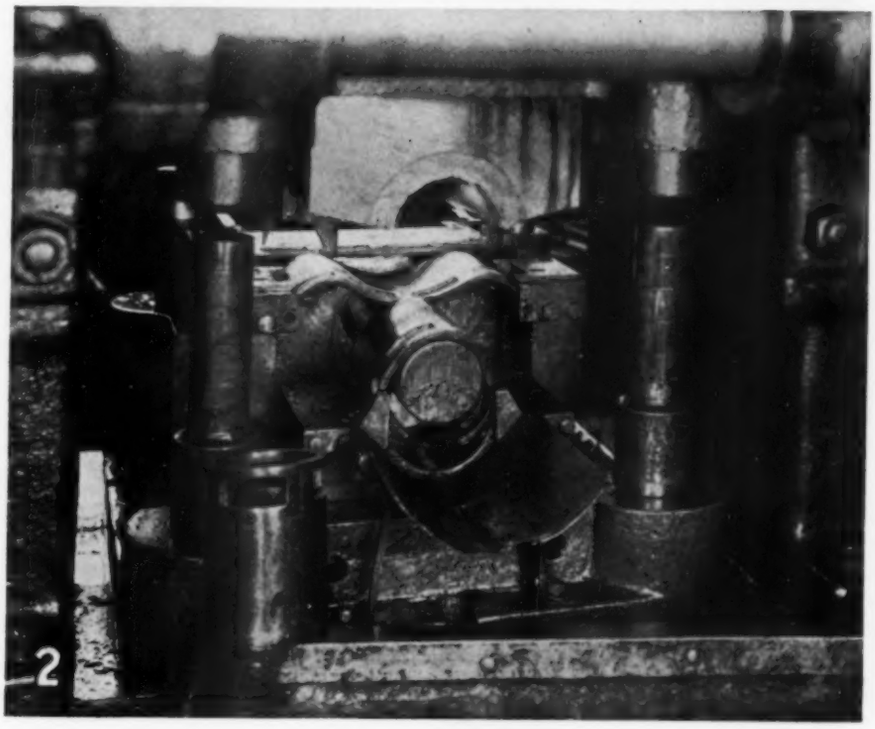
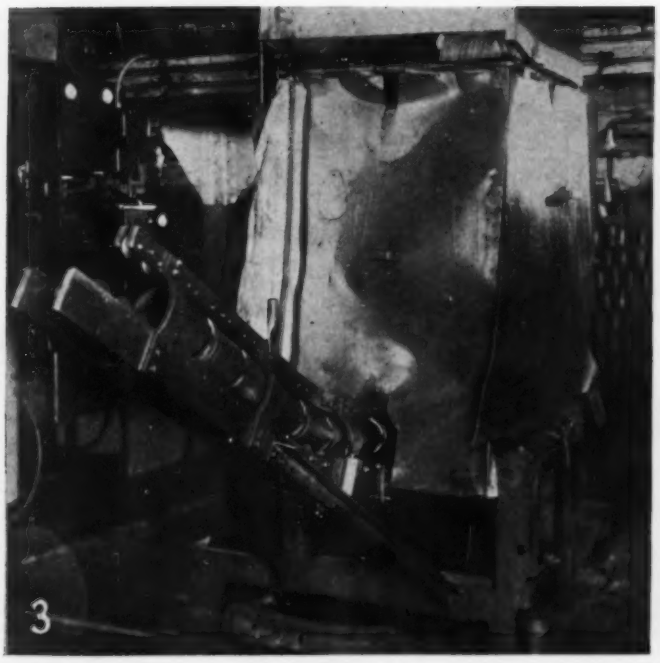
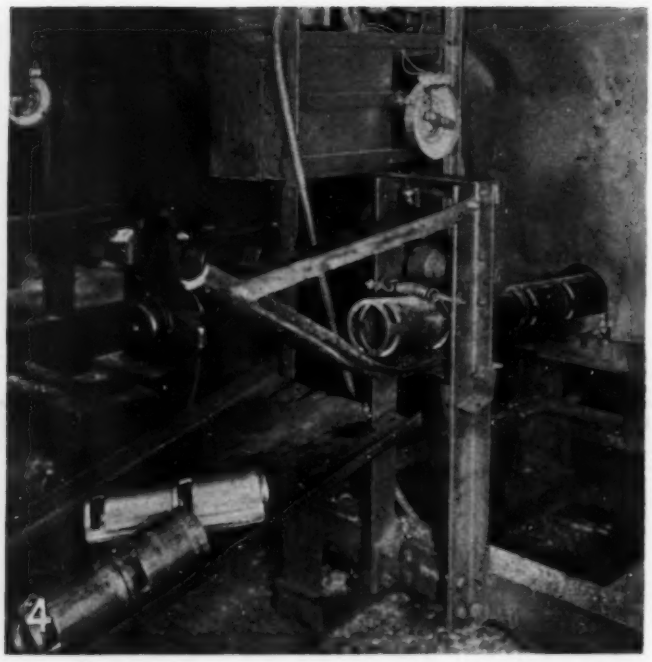


Fig. 1—Blanking of the starter frame is performed in a progressive die which first punches the four rectangular holes and then cuts the piece from the strip. Fig. 2—Three operations are required for forming: a double reverse bend, partial closing around an arbor and then a final strike between semicircular dies





Figs. 3 and 4—Frames are automatically fed to a butt welder on an inclined roller chute; they emerge into a trough at the opposite end of the machine

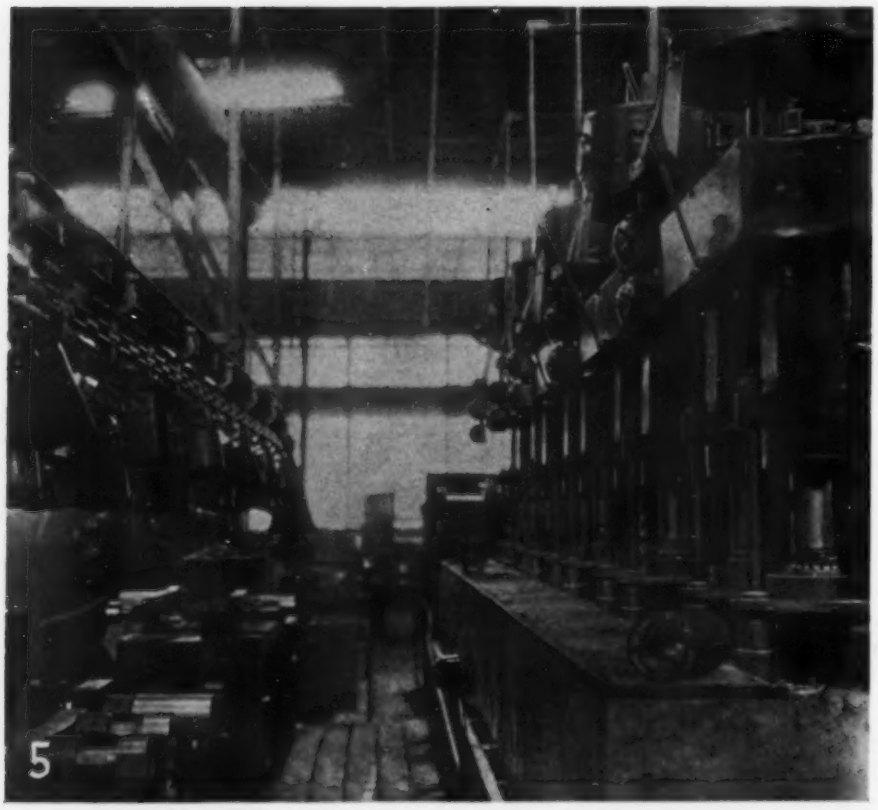


Fig. 5—Boring is done in a battery of Baker reaming machines; gages may be seen at the lower left

2, which gives an idea of the dies used and the way the blanks feed through the press. The final forming is so accurate that the closed barrels go direct to the welder, Fig. 3. Here the pieces are simply fed into the inclined chute which acts as a magazine and come out of the other side, Fig. 4, welded and ready for the adjacent conveyor, which carries them to floor above and directly to a battery of Baker machines, which ream the holes at one pass. These boring reamers receive careful attention and leave a remarkably good finish, the only machining done on the inside. This operation is seen in Fig. 5 which also shows the "go" and "not-go" plug gages in left foreground, between the row of machines and the conveyor. There is a similar line of machines the other side of the conveyor, this line having its own gages.

From here the frames go to Stub lathes that face both ends with the work held on an expanding mandrel. Next comes the drilling, most of which is done on Kingsbury drilling machines, as in Fig. 6. A few holes are left, however, to be done on an auxiliary machine. Any burrs left by the drills are removed in a short operation using a rotary file inside the frame.

Pole Pieces

Pole pieces are cut by saws from special drawn stock, the only machining necessary on these being drilling and tapping the hole by which they are held inside the frame, and coining to maintain size and shape. This coining is done in a 600-ton press, and every piece is inspected as it leaves the press to insure not only proper size but that the curvature of the outer side shall fit the frame and the inner side leave the correct air gap around the armature. This operation, together with the inspector's gage, is shown at *A*, in Fig. 7.

Armature shafts are turned from the bar on Gridley multiple spindle automatics, ground on centerless grinders and knurled on a Waterbury machine of the thread rolling type shown in Fig. 8. The knurling is well done on

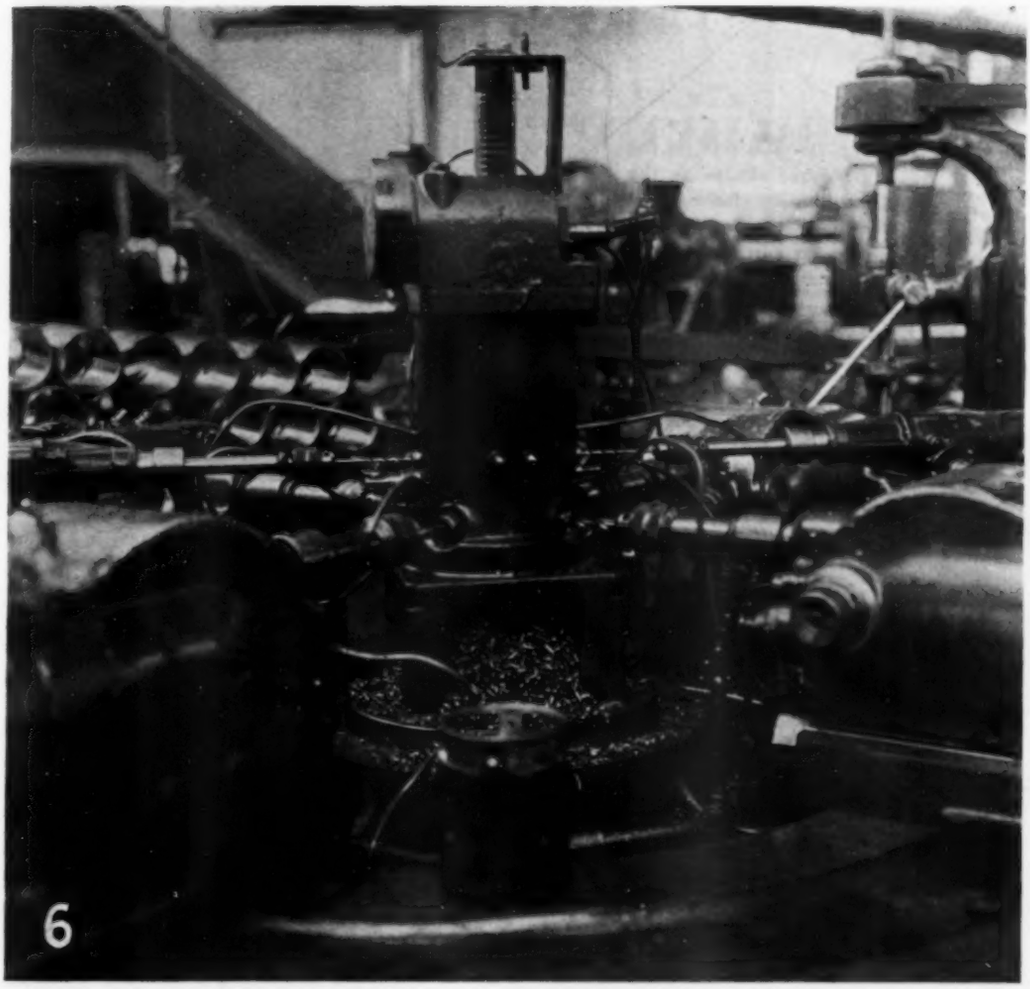


Fig. 6—A Kingsbury 5-way drill machines most of the smaller holes with the work held in an automatic fixture

Fig. 7—At *A* is shown a special inspecting device which checks the pole pieces as they leave the coining press

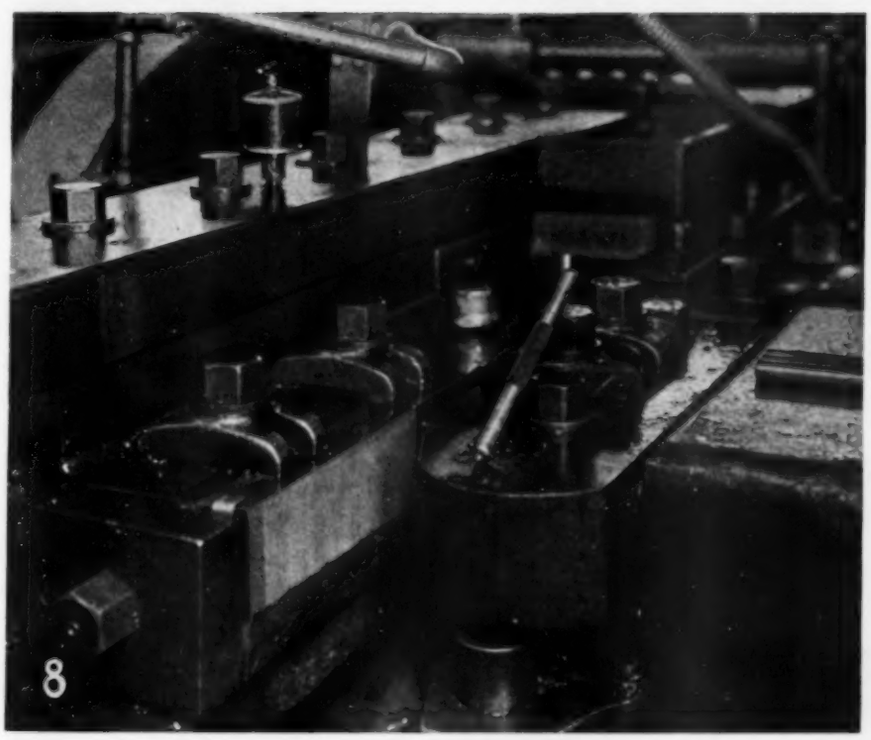
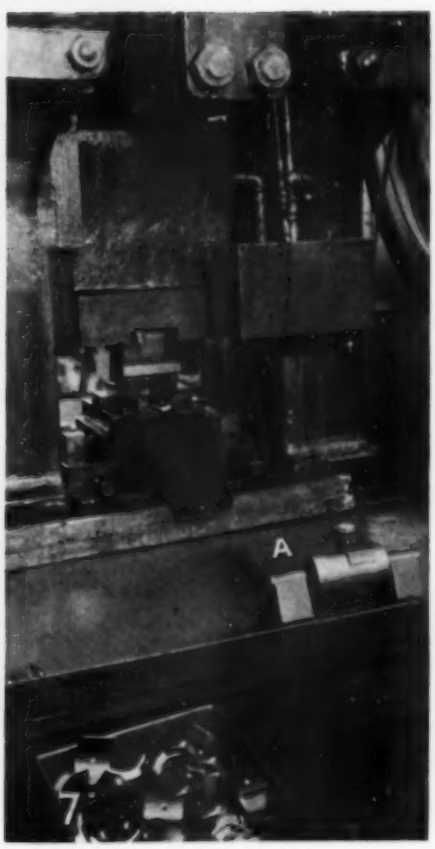


Fig. 8—A Waterbury thread rolling machine affords an efficient means of knurling the armature shafts



two diameters and insures a secure fit of both armature laminations and commutator.

An ingenious method has been devised for removing the always bothersome tit left on the end by the cutting off tool. A small bench machine, carrying a slotting saw on a spindle, has a work guide at right angles to the saw and central with it, as in Fig. 9. The operator pushes the shaft through the hole and against the saw, turning the shaft slightly with the hand. A second or two contact with the saw removes the tit, does not cut the shaft, and he places the work in the centerless with no appreciable delay. The shafts are heat treated and have a finish grind, also in the centerless.

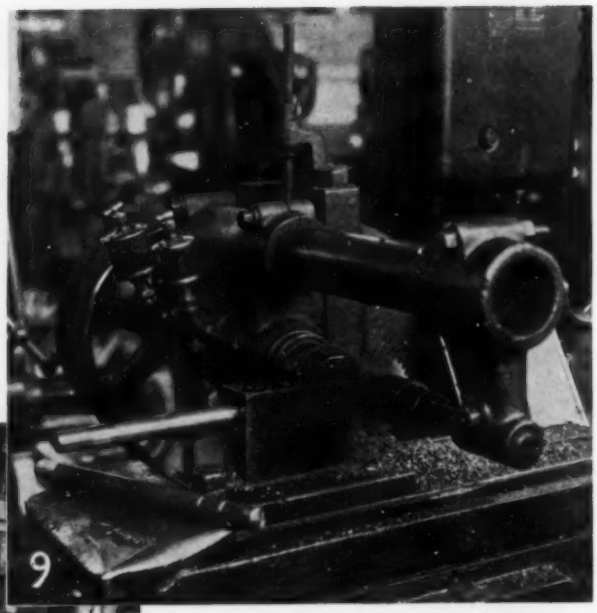


Fig. 9—Tits left on the armature shafts by the automatic lathe are quickly removed by a circular saw before the work is centerless ground

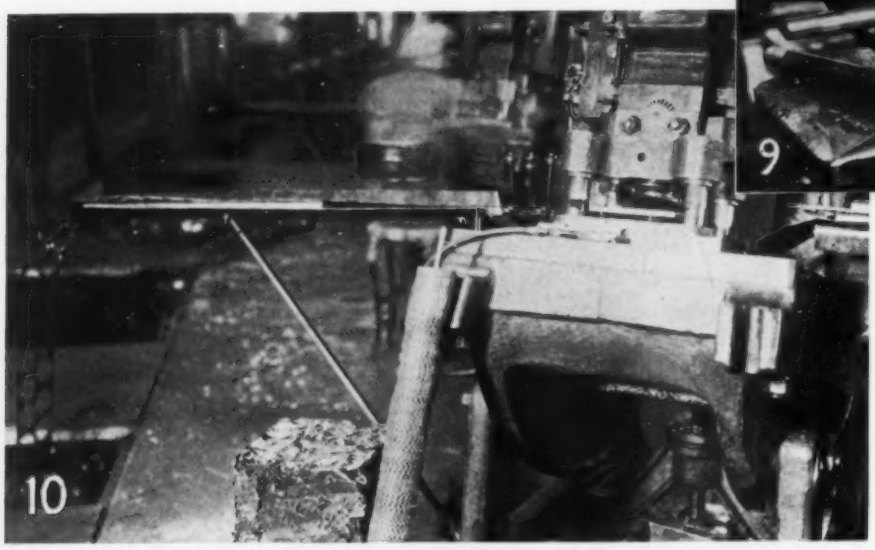


Fig. 10 — After being stamped out on a high-speed inclined press armature disks are automatically stacked on rods

Armature disks are punched from the strip and automatically stacked on rods placed beside the punch press. The scrap drops on a conveyor and is carried to presses for bailing it. This operation, showing the stack and the scrap both before and after baling, is shown in Fig. 10. When these rods are full they are hung on a convenient conveyor and go to the assembly department. Here they are sorted into sets for a single armature by two methods. Some are counted by weight and others by a special thickness gage.

Lining up the Slots

Following this is another ingenious device for lining up the slots for further assembly operations. A stock of disks are dropped over one of the pins shown in Fig. 11, while the pin and its holder is pulled out, away from the revolving brush. When the pile of disks has been dropped in place, the pin holder is returned by a spring so that the brush contacts the edge of the disks. This brush has only a bunch of wires on a small portion of its periphery. These act on the outside of the disk, catch in the slots, and almost before you know it, all the slots are in line. The two pins enable this to be continuous operation, one set being lined up while the other is being loaded. The set is kept in alignment until the shaft is forced into position. Fig. 11 also shows the air-operated press which flattens the stock of disks before they are lined up.

A second article on this subject will appear shortly.

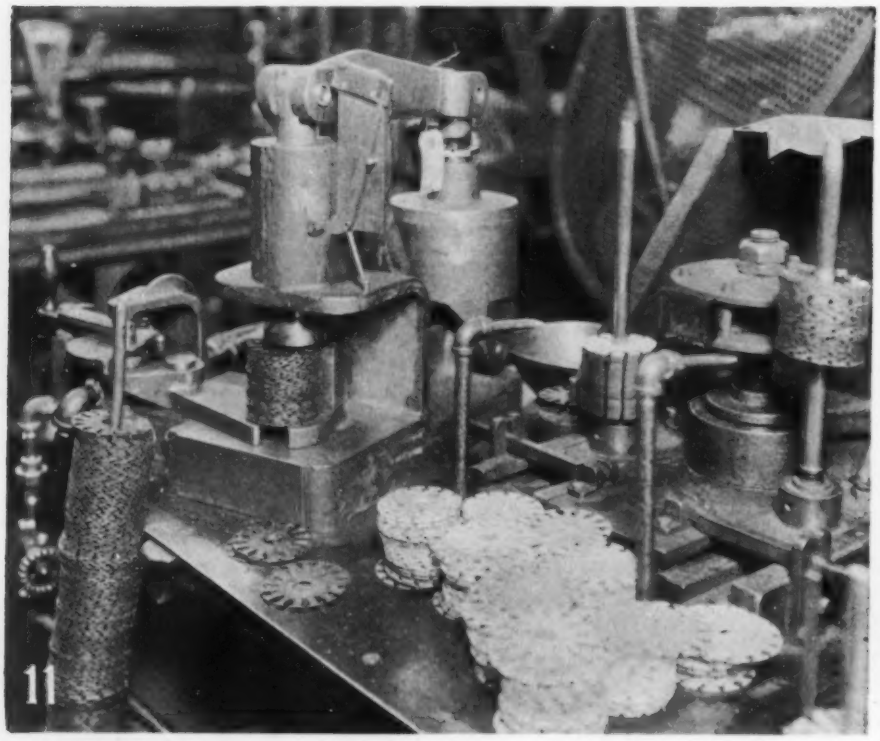
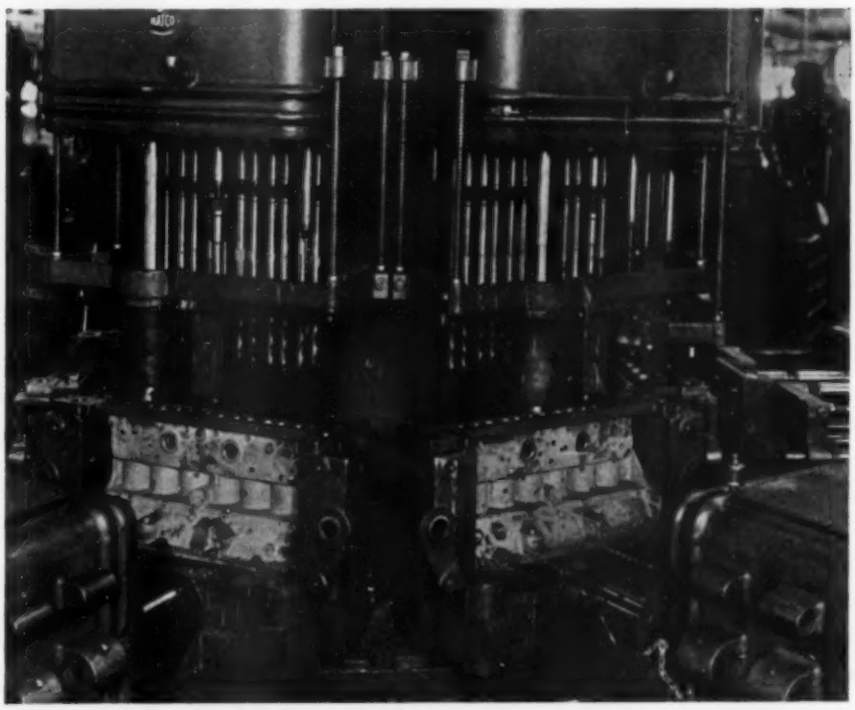
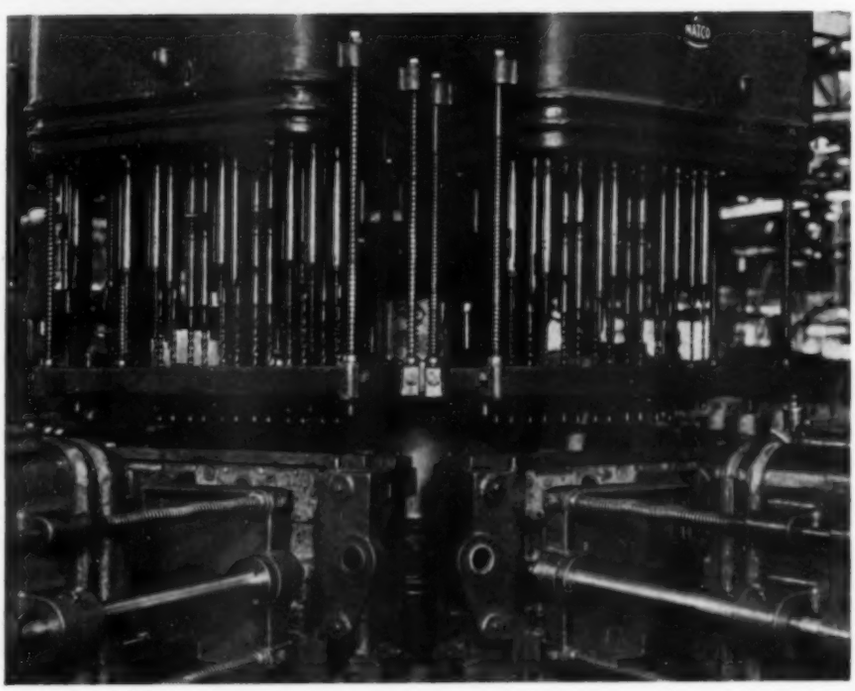


Fig. 11—Slots in the armature disks are aligned by mounting the parts on arbors and holding them against a segmental wire brush

Motor Parts as Machined by Plymouth

A selected list of operations on the cylinder block and allied parts reflects the advances made by this high production manufacturer





Cylinder-Block Drilling

The importance of drilling machinery, and the way in which some of the drilling problems have been met in the Plymouth cylinder block line, is shown in detail in the two illustrations at the right. This Natco machine has four stations for drilling and two for loading and unloading, which of itself, gives some idea of the production secured. Complete push button control is provided at each loading station so that all spindles can be stopped instantly, if necessary.

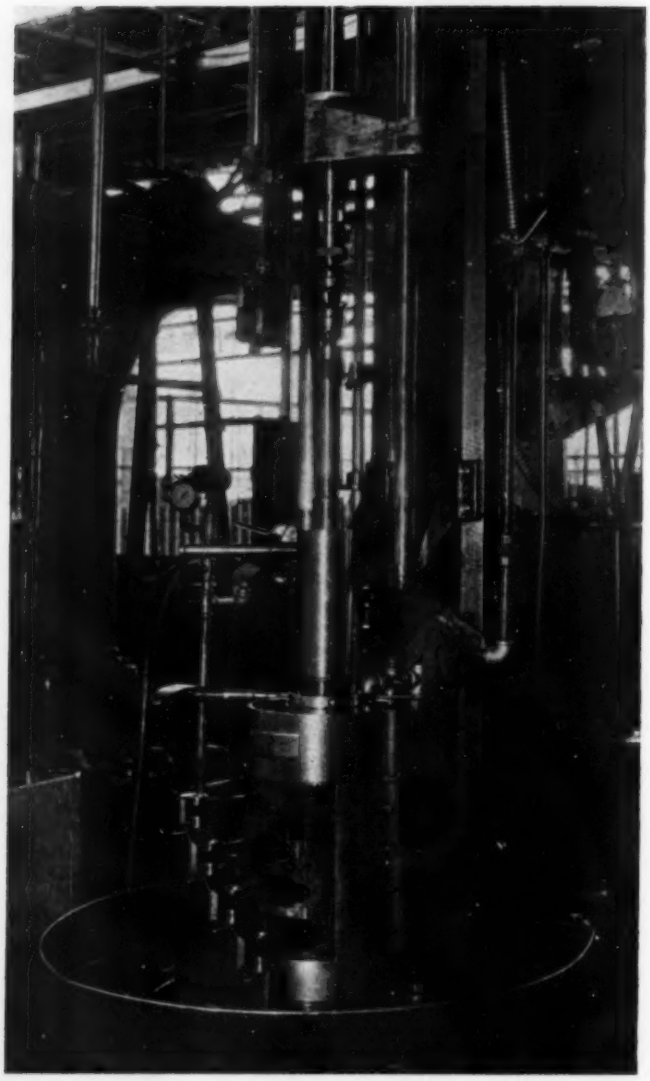
Four horizontal and four vertical drill heads carry 114 spindles, in roller bearings. Each head has semi-automatic hydraulic feed and can be controlled independently for setting up purposes, besides the complete 16 push putton control mentioned. A three-position automatic mechanical indexing mechanism moves the table from station to station, but the entire machine is so interlocked that it will not index unless all eight drill heads are clear of the work.

Six stationary fixtures hold one cylinder block in each, locating on the lower surface of the block by two dowels. The clamp is manually operated.

Guide bars extend through the drill bushing plates and into the fixture, as in the lower figure, insuring correct alignment of all holes. Two of the vertical drill heads, top figure, carry auxiliary, extension drill spindles which reach down, with their guides, quite a distance below the main plate. The large one at the left bores the opening for the oil filler pipe in the crankcase and the other the hole for the oil gage. These extensions save a second operation.

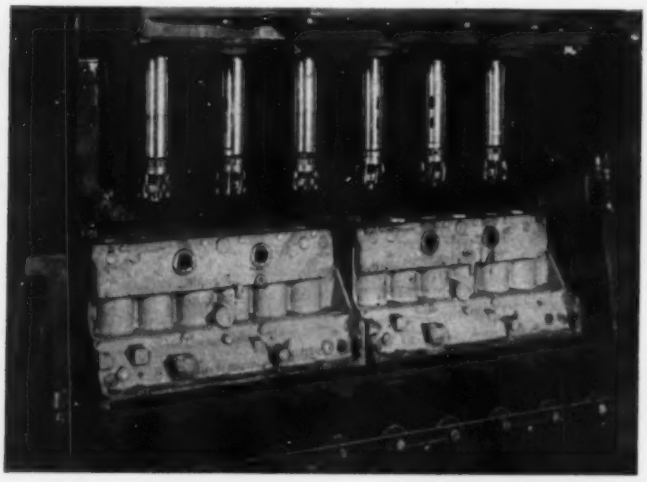
Rough Boring Cylinders

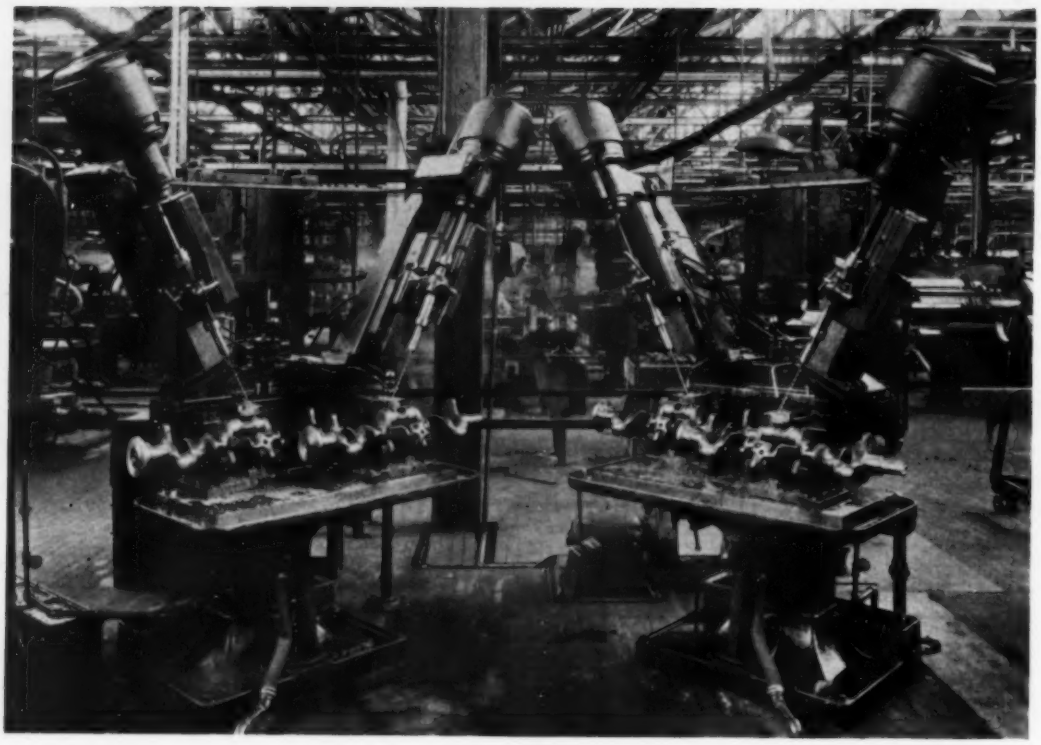
Plymouth cylinders are rough bored in a special Fitchburg machine. In order to secure rigidity of spindle bearings every alternate hole is bored by the bars. But the use of six bars in a double machine gives a complete block at each feeding movement. After the first three holes are bored by the set of spindles at the left the block is moved to the right and a new block put in at the left, as shown in the illustration. The next feed movement completes the right hand block. The clamping of the blocks and the shift from the first to the second position are automatic.



Set-Up for Crankshaft Oil Holes

There are shown two of a battery of eight Leland-Gifford hydraulic feed machines each of which drills two oil holes in the crankshafts. The tools are guided by bushings just above the shaft. Each head has a special intermittent, hydraulic feed that withdraws the drill at frequent intervals to clear the chips.





Honing Connecting Rods

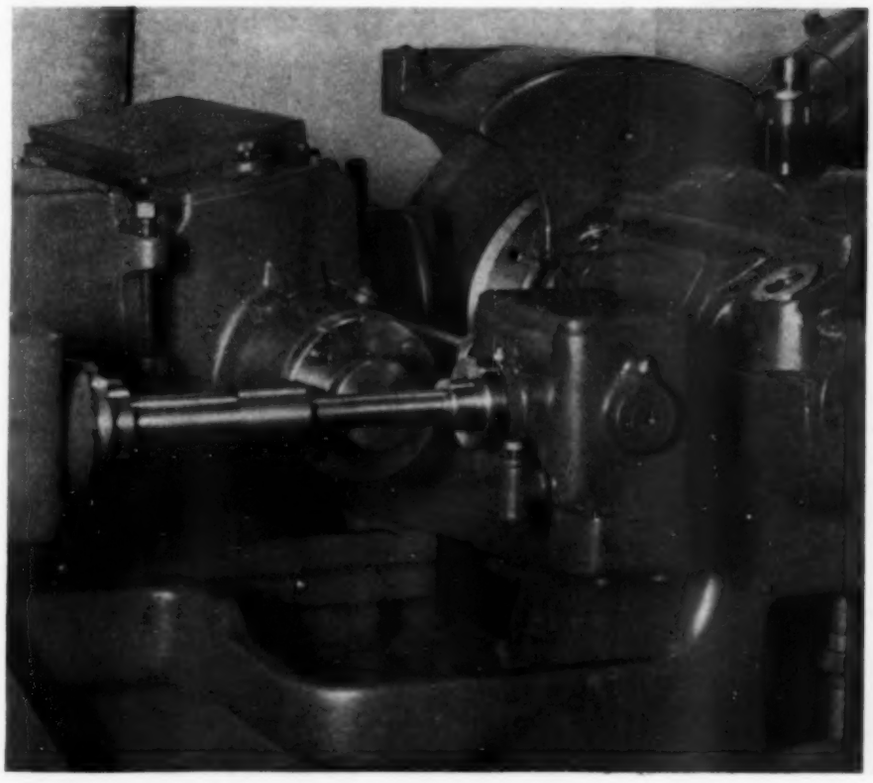
One of the features of the Plymouth motor is that the large end of the steel connecting rods is not only reamed but honed to within 0.0003 in. tolerance to receive the new type shell bearing that runs on the crankpin. Successful honing is generally limited to pieces where the length is at least as great as the diameter. In this Micromatic machine the desired length of honing surface is secured by holding the rods in groups of four as shown at the left. The holding fixture is so designed that each piece floats and so avoids all accumulated error. The hone also floats.

From 0.0007 to 0.0012 in. of material is left for honing and the tolerance noted is secured at the rate of 40 sec. per rod, floor-to-floor time. The hones are good for 500 rods.

Grinding Relief on Pistons

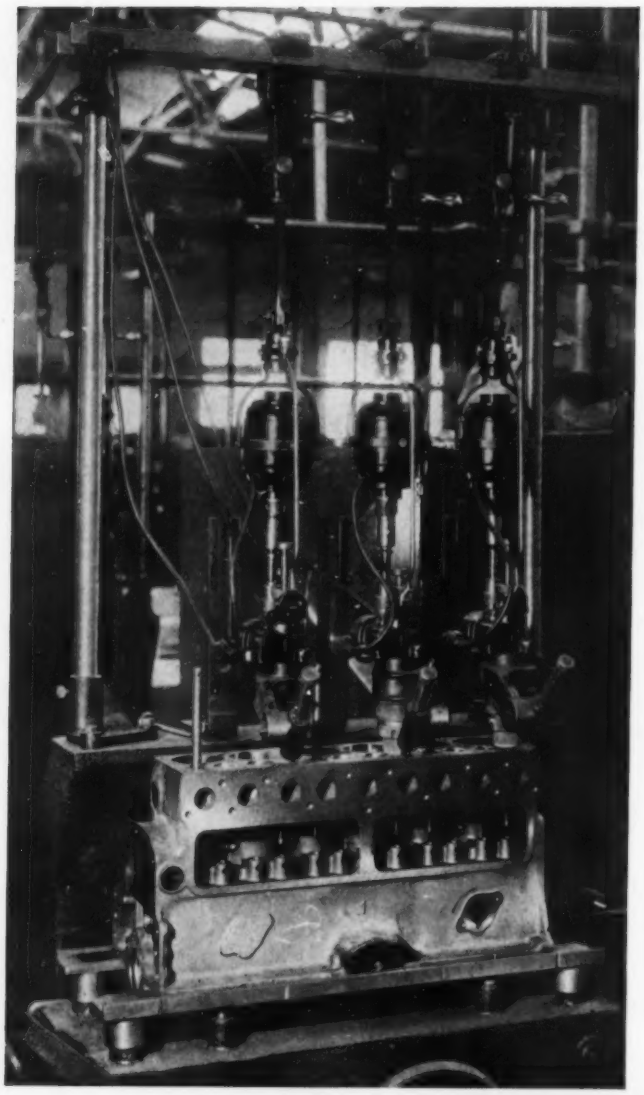
Among the refinements in modern automobile motors is the relief of pistons on the sides over the pin bosses to compensate for the increased expansion on this diameter. In the Plymouth plant this relief is secured on a Cincinnati centerless grinder with an infeed attachment equipped with a special regulating wheel housing which gives the desired movement to grind the piston elliptical and a special work driver positively timed in relation to the rotation of the regulating wheel. The regulating wheel is of steel and is in effect a master cam governing the contour of the piston. Since the circumference of the regulating wheel is three times that of the piston, its contour forms six "lobes" and six "recesses." The "lobes" on the regulating wheel shorten the distance between the regulating wheel and the grinding wheel causing reliefs to be ground 180 deg. apart on the piston.

In order that the relief will always be ground on the axis through the pin holes and in order to prevent slippage in the relative angular positions of the piston and the regulating wheel, it is necessary positively to drive the piston. This is done by having a positive drive directly connected with the drive of the regulating wheel, the drive turning a fork, the rotary speed of which is three times that of the regulating wheel. This fork fits snugly over a special pin placed through the pin holes of the piston and rotates the piston



three times each rotation of the regulating wheel.

Reviewing the entire cycle from a point when one piston is finished to a corresponding point on the next piston, the action is as follows: The infeed attachment withdraws the slide bearing the regulating wheel and housing from the work. When the regulating wheel is entirely withdrawn, the ejector cam in the infeed attachment, which on standard machines is used to eject the work, disengages the single finger clutch and stops the positive drive mechanism. At the same time a limit switch on the infeed attachment is also thrown by another cam, stopping the infeed attachment. The operator then removes the finished piston and places another on the fork and two blades. A switch is pressed starting the infeed attachment. The ejector cam then releases the single finger clutch and the positive drive unit engages. The automatic infeed attachment then feeds in the slide until the piston is finished, retracts the slide, and the same cycle is then repeated. The entire cycle is very rapid and each machine grinds over 300 pistons per hour.



Grinding Valve-Seat Inserts

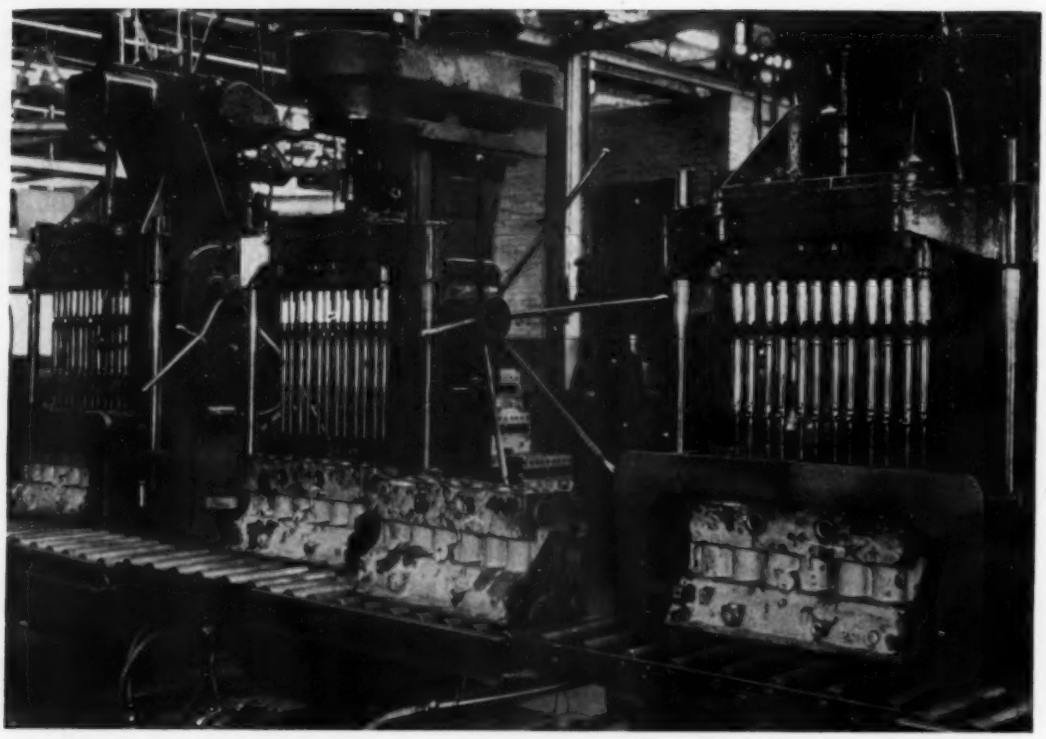
After being forced into place, the separate steel exhaust valve seat inserts are ground, but instead of being fed straight down the cone-shaped grinding wheel has a planetary motion that carries it around the seat. This grinds the seats to the proper angle and avoids any tendency to score the inserts by carrying the particles of abrasive clear around the circle. There are three of these special grinding heads, shown at the left, so that all six seats are ground at two settings. In addition, each grinding head carries a diamond wheel dresser, guided at the proper angle to give the wheel the correct shape for its work.

The grinding wheel heads are positioned by well fitting guide pins that slide into the valve bushings below the seat. This insures the seat being ground concentric with the valve stem guide.

Four doweled supports hold the cylinder block during this operation; these are withdrawn when the block is moved to the next set-up.

Boring Valve Throats

The conveyor line passes the three multiple spindle drilling machines as shown below which bore the valve throats and the holes for the valve guide bushings. There are twelve spindles in each machine, and the spindle heads are guided by the bars that keep them in line with the work fixture.



EDITORIALS

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EDITORS

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Bait or Bludgeon?

VARIOUS PLANS aimed at reviving the purchase of durable goods and capital goods are being considered both in Washington and in industrial circles. Is it necessary to stimulate revival or will it come of itself? If it is necessary to take measures should they be of the nature of bait or of bludgeons?

The answer to the first question is yes. No better evidence of this fact is needed than the vigorous efforts of Jesse Jones and his Reconstruction Finance Corporation to get industry to accept more loans and bigger ones. The Corporation has done excellent work in rescuing railroads and bolstering up banks, but its achievements in support of industry have been pathetic. Its failure is not entirely the fault of its directors—one great handicap has been the natural reluctance of industry to accept federal loans that imply federal control.

Looking at this question from the more academic or abstract viewpoint of an economist like Malcolm Rorty, president of the American Management Association, we find further support for our contention. Mr. Rorty believes that there is a critical point in the down swing of the business cycle. If business recedes below this critical point it is powerless to recover unaided. The government or some other outside agency must come to its assistance. Such a point was passed in the present depression cycle.

ASSUMING THAT SOME FORM of aid to business and industry is necessary, what form shall it take? Shall it be bait to lure the coy denizens of the industrial deeps to come out of hiding and show some activity, or shall it be a bludgeon to force action despite the reluctance of the bludgeoned?

Both types of stimulus are under consideration. A bait that appeals to us as having immense possibilities is the proposal to permit deductions from gross income tax calculations of any amounts spent for durable or capital goods. This proposal has already encountered vigorous opposition from the Internal Revenue Division which is concerned solely with increasing tax revenue as much as possible. On the face of it this provision would result in an immediate loss of revenue, but it is a practical certainty that it would so stimulate the sluggish heavy industries that the loss would be more than made up by taxes on their incomes which are now only losses.

This principle is practically the same as the one that has been applied so successfully in Germany, and that is largely responsible for the present activity of German plants building machine tools and other varieties of production equipment. It is essentially a practical method of bringing home to administrative heads of industrial organizations the soundness of the contention of their manufacturing executives that old equipment is too expensive to keep in operation.

Another proposal that would be certain to stimulate purchases of capital goods is the plan to tax corporation surpluses. In the frenzy to keep assets liquid, which has been perfectly understandable under the conditions of the last three years but which has been carried to uneconomic extremes by banker dominated company managements, utterly unsound policies of postponing equipment replacements have become the vogue. Under normal conditions a reasonable proportion of such surpluses would be spent for maintaining plant. A tax on them would hasten a return to normal in this respect even though it might have unfortunate results otherwise.

If there is a choice of method we prefer the bait to the bludgeon as being more likely to produce satisfactory and lasting results. It may well be, however, that both means will have to be used to resuscitate the industries that are responsible for half of our unemployment and contribute largely to the other half. In any event business, industrial and financial leaders should study these proposals and offer constructive criticism of details for the benefit of the Administration. They should also take steps to educate Congress. Admitted that the Administration will frame the legislation, and that Congress is sure to follow Mr. Roosevelt's leadership, it is just as well to be sure that that leadership can be followed by an informed legislature.

Industrial Training

ONE OF THE disheartening features of the unemployment problem is the large numbers of both sexes, who are unemployable because of lack of training. Even those who may have been fair workers two or three years ago have lost their skill even if they have not become too discouraged to tackle the job. Much of this difficulty could have been avoided if they had been properly trained in the first place. Too much training is superficial and does not touch the fundamental principles of the work to be done.

It is part of industry's problem to know what kind of training is necessary even if it is in no position to put it in practice at present. In fact there is a growing belief that primary training is a function of the educational system, rather than of the shop. Few educators believe that they can turn out expert craftsmen, but there is good evidence that a school of some sort can lay a foundation which will greatly reduce the time required after the boy goes into the shop itself.

Four Hundred Per Cent!

INVESTMENTS that pay even ten per cent are considered as speculative rather than conservative, and twenty-five per cent dividends cause a feeling of uneasiness as to the safety of the principal. Some of the large users of machine tools, however, do not seem to be troubled in this manner. For, according to builders of time-saving machine equipment, they are demanding that the new machine pay for itself in three months. Four hundred per cent is a rate of return that most of us would call usurious.

If an investment in machine tools is to be written off in three months, would it be unreasonable to suggest that they should be replaced at the end of the year?

.CHIPS.

Washington—FERA abolishes 30 cents an hour minimum relief wage which has been so destructive in many sections . . . Department of Interior orders a Ford truck . . . NRA sets up ten autonomous regional offices to handle compliance questions . . . Concessions in taxes if money is spent on building or for durable goods are under consideration . . . PWA and FHA chiefs representing left and right wings of the Administration lock horns on which is going to build all those houses and have to be set straight by long distance telephone . . . PWA will build houses for those who are broke, FHA for the rest of us . . . Edison Electric Institute starts suit to determine legality of TVA . . . FERA approves tentatively 50 rural-industrial communities despite Controller General's ruling that PWA funds cannot be used in this fashion . . . Studies under way looking to establishment of machinery for government insurance of bank loans to industry for modernization of plant . . . Senators Harrison and Robinson, after visit to Roosevelt, say outlook is for conservative fiscal program.

Foreign—Hungary accused by three neighboring countries of harboring terrorists and sharing responsibility in assassinations . . . Soviets plan new railroad facilities for Siberia including double tracking of existing line . . . Send gold ore to be smelted in Tacoma . . . Reversing previous decision British decide on arms investigation . . . Bread cards are abolished in 175 Soviet towns . . . Record military budget approved by Japanese cabinet . . . Tokyo's finance minister resigns after failure to hold down military spending . . . Japanese ambassador to U. S. explains in speech why Japanese pride can no longer stand a naval ratio agreement . . . Treaty will be denounced and will expire in 1936 . . . Likelihood of U. S.-British understanding on naval building increased . . . Reichswehr and Special Guards struggle for supremacy in Germany . . . Canada is preparing for unemployment insurance legislation as recovery continues.

Industry—280,000 added to payrolls in October . . . Federal Housing Administration reports sharp advances in building modernization expenditures in October . . . Industrial production up in October, according to Federal Reserve figures . . . Paterson dye plant plans removal of plant because of frequent strikes . . . Twelve building trade unions defy A. F. L., refuse to attend meeting . . . Navy places orders for 36 large diesels for six new submarines.

Trade—Hutchinson Committee urges lower tariffs, settlement of war debts by swapping old obligations of Southern States and municipalities, held abroad for debts owed us, cessation of agricultural production restriction, Tariff Commission control of rate fixing, etc. . . . Mary Van Kleeck tells Industrial Relations Institute of alarming insufficiency of food supply and of clothing . . . Exports up sharply in October, imports down a little.

Indicators—Steel production climbs steadily higher in counter seasonal improvement . . . Carloadings are off . . . Electric power production increases to 1,705 million kw.-hr. . . . *Business Week's* index rises slightly to 58.4.

MAPI Plans Program on Relations With Administration

CINCINNATI—More than 200 employers of the machinery industry considered common problems and methods to speed recovery at the Gibson Hotel, in Cincinnati, on November 21, in a series of conferences and meetings.

Among the principal speakers at the Machinery and Allied Products Industry meeting, after reports by John W. O'Leary, chairman, and George P. Torrence, treasurer of the basic code authority, was W. Averill Harriman, administrative officer of the National Recovery Administration, one of the country's leading industrialists, being chairman of the board of the Union Pacific Railroad, who spoke of the opportunities of MAPI subdivisions in guiding the future course of NRA.

In an address, "Cheer for the Machinery Industry," Colonel Willard T. Chevalier, vice-president of the McGraw-Hill Publishing Co. stated that "The time has come to call a halt to retreat and fight our way back—America is not built up; it is run down at the heels."

Three-Point Program

Seeking job creation first, the MAPI group was the largest to have gotten together in a decade. The second objective and one discussed informally and presented by various leaders was the development of the plan to get machinery trades to agree to scrap their obsolete machinery and equipment, and to urge their customers, including governmental departments, particularly the War and Navy Departments, to junk their obsolete machinery. Still a third objective was to obtain an opinion from the employers of the machinery industry as to what to do about the NRA program.

The meetings on November 21 were four-fold, starting in the morning with the annual meeting of all employers of MAPI followed with a luncheon. In the afternoon there was a special MAPI meeting and the day closed with a dinner meeting, conducted jointly under the auspices of the industry and the Institute. Other meetings held were those of the advisory committee of MAPI and various industry and code authority meetings.

At the luncheon meeting, the keynote was struck in the address of Colonel Willard T. Chevalier, whose vivid exposure of the condition of the industry and presentation of a platform for the future met with unanimous approval.

At the special meeting of MAPI, the speakers were Harry C. Beaver, vice-president of MAPI and president of the Worthington Pump and Machinery Co., and Colonel George T. Buckingham, MAPI counsel, who spoke on the "Legal Status of Trade Associations."

The feature of this meeting was the presentation of varying opinions about NIRA by Robert M. Gaylord, president of the Ingersoll Milling Machine Co., and by Guy A. Wainwright, president of the Diamond Chain and Manufacturing Co. The arguments ably presented by both speakers were pertinent, since NIRA is emergency legislation and expires by law on June 16, 1935. The purpose of NIRA was to promote recovery through codes of maximum hours, minimum wages and collective bargaining and simultaneously to afford relief from specific restrictions of anti-trust laws by incorporation of exceptions in approved codes.

In questions considered consistent to the issue were the following:

1. Do you believe that Congress should enact permanent legislation to effect the above purposes?

2. Do you believe that Congress should enact such legislation for some limited period only?

3. Do you believe that Congress should enact legislation providing only for maximum hours, minimum wages and collective bargaining through codes?

4. Do you believe that Congress should permit the Act to terminate without further legislation?

Other features discussed were government expenditures; Executive Order No. 6767 pertaining to the quoting of prices to the Government of not more than fifteen per cent below prices filed in accordance with the requirements of the codes; and the desire of developing the industry's unity of action in connection with future Federal legislation.

George H. Houston, president of the Baldwin Locomotive Works, made a clear and informative address on the question of, "Social Insurance—Old Age Pension and Unemployment Insurance."

At the dinner meeting the speaker was Samuel O. Dunn, Editor of *Railway Age*, whose topic was: "Railroad Buying and Machinery Selling are Interdependent Equations," and in an exposé of the condition of obsolescence in the railroad business, traced the demoralizing effect caused by lack of railroad purchasing on employment in the railroad business and on the nation as a whole.

In a barrage of figures which culminated in indications that the movement was upward, he stated, "The still profoundly depressed durable goods industries are the key to the present economic situation and recovery and can go no further without revival of the durable goods business and re-employment. The railroads are among their biggest customers."

The entire meeting was full of discussion on the ideas of the industrialists present, and the following extracts also indicate the trend of thought:

"It is essential that Congress have the benefit of your counsel," W. Averill Harriman, administrative office of the NRA Board.

"Industry unhesitatingly has supported the viewpoint that distress created by unemployment should be relieved and national recovery therefore depends on the revival of the durable goods industry," George Houston, president of the Baldwin Locomotive Works.

ASME to Honor Prominent Members

Willis H. Carrier, chairman of the board of the Carrier Engineering Corporation and its subsidiaries, has been awarded the medal of the American Society of Mechanical Engineers for 1934, "in recognition of his research and development work in air conditioning." This medal was established by the Society in 1920 and is awarded for distinguished service in engineering and science. Mr. Carrier is past president of the American Society of Refrigerating Engineers, and of the American Society of Heating and Ventilating Engineers.

Ralph E. Flanders, president of the Jones & Lamson Machine Co., and a member of the Business Advisory and Planning Council appointed by Secretary of Commerce Roper, was awarded a Worcester Reed Warner gold medal for his "contribution to a better understanding of the relationship of the engineer to economic problems and social trends." For many years Mr. Flanders has been a leader in the public service activities of the engineering profession and has been actively identified with the Federal recovery program.

The Charles T. Main award, carrying an annual stipend of $150 went to Philip P. Self, formerly a student at Colorado State College, for paper on "Air Conditioning—Its Practicability and Relation to Public Welfare." This award was established in 1919 to be awarded to a student of engineering for the best paper within the general subject of the influence of the profession upon public life.

The awards will be presented during the annual meeting of the Society, to be held at the Enginering Societies Building, New York, December 3 to 7.

Detroit Swings Into New Car Building Season

DETROIT—October factory sales of passenger cars and commercial vehicles totaled 132,488 in this country and 3,780 in Canada, 2,000 less than the same month last year for the two combined. For the first ten months of this year over three-quarters of a million more cars were produced in the United States than for the same period last year and 1,313,316 more than in 1932. With November weekly totals for the entire industry reported as generally less than that recorded for single volume producers earlier in the year, November output is not likely to exceed the 60,000 of last year. Seven companies, including four volume producers, have been closed for varying periods throughout October and November for new model preparation and will not be in a position to affect the November total. December will tell a different story.

New automobile financing for October decreased 11.3 per cent below September, which is the smallest drop recorded in the last several years, including 1929.

Hupp entered November with four times as many orders on the books as recorded October 1, and Hudson-Terraplane reports that over one million offers in orders for delivery by December 31 had to be refused. Releases to Hudson suppliers are understood to be on a conservative basis.

Foreign overseas business of General Motors increased 84 per cent over the first ten months of 1933. With 22 per cent of the foreign market, General Motors enjoys the largest share ever attained. The interest and backing given by the A.M.A. to reciprocal trade agreements evidences the recognition of the importance of foreign outlet for American automobile production. In 1929 over 250,000 cars were sold to countries south of the equator; the revival and extension of this market offers an opportunity to even the production curve because the selling seasons are reversed. The Cuban treaty has resulted in a much heavier automotive consumption than last year.

With previews held of Hudson-Terraplane, Olds, Ford, Dodge, and Studebaker, new model output is scheduled to increase markedly in December. Workers are being called back to factories in moderate numbers and optimism is generally noticeable. One large supplier, serving most units in the industry, reports dies 80 per cent complete on 1935 business while others are reporting capacity contracts already signed. Capacity production is anticipated in some units in the industry by the middle of December.

Oldsmobile is the latest entrant into the growing class of companies expanding and rearranging plant facilities to provide for anticipated increases in 1935 business. This group already includes Ford, Murray Body, Fisher Body, Packard and Pontiac. The Olds development is to care for an anticipated 1,000 output per day and includes new presses, heat-treating furnaces, lapping, welding and material handling equipment. With buildings for units, such as axle and engine, feeding into a long assembly building running at right angles to them, this company has one of the most efficient layouts in the industry. Completion of all of the original plan was held up by the onset of the depression, and the present development is a continuation of it.

The proposal mentioned in this column before of selling Willys cars through Hupp dealers is now out of the picture. The model 517 recently announced gives the company its own car for the low-priced field. Distribution of the Citroen low-priced front wheel drive car through the dealers of a company in this country has in all likelihood been hindered if not balked by European reports on Citroen status.

Employment in Detroit tool and die shops in November was 50 per cent greater than in late summer and is about equal to that prior to the strike early in the year. In general, plants in this area have more business than in other centers in the country. Total volume is not known, but less has been sent out than last year. A code meeting for the industry will be held in Detroit in early December.

Willingness of manufacturers to meet reasonable requests of employees evidenced, among other things, by the substitution of the straight day rate for various incentive plans formerly used and the President's avowed intention of making a study of seasonality in the industry undoubtedly accounts for the absence of labor difficulties at present. The Research and Planning division of NRA in conjunction with the Bureau of Labor Statistics, was designated on November 24 to make the study. Presumably the results will be available at the code expiration date February 1.

Low earnings so far this year serve as deterrent to capital investment discussed in the last issue. While considerable buying of special equipment has been done to provide for anticipated expansion and engineering changes, stand-

Exports of Machinery During October, 1934

	October 1934	September 1934	October 1933
Electrical machinery	$5,912,329	$5,367,573	$4,592,168
Power generating machinery (except automotive and electric)	573,787	480,696	394,863
Construction and conveying machinery	544,874	471,093	238,552
Mining, well and pumping machinery	2,342,213	2,895,191	1,380,744
Power-driven, metal-working machinery	1,290,407	1,204,527	930,947
Other metal-working machinery	166,158	142,634	113,490
Textile machinery	543,907	611,803	484,384

Exports of Metal-Working Machinery During October, 1934

	October 1934	September 1934	October 1933
Engine lathes	$56,532	$38,215	$40,007
Turret lathes	47,479	58,191	30,635
Other lathes	28,651	63,827	41,953
Vertical boring mills and chucking machines	10,053	38,654	15,490
Thread cutting and automatic screw machines	83,606	70,045	11,812
Knee and column type milling machines	52,177	71,556	12,673
Other milling machines	57,084	54,905	81,580
Gear cutting machines	114,290	52,334	42,546
Vertical drilling machines	30,391	17,318	1,395
Radial drilling machines	5,895	2,640	14,289
Other drilling machines	35,825	55,162	46,021
Planers and shapers	7,400	9,581	15,689
Surface grinding machines	23,303	31,520	14,061
External cylindrical grinding machines	30,004	31,435	33,206
Internal grinding machines	41,626	32,093	37,719
Tool grinding, cutter grinding, and universal grinding machines	56,479	37,266	28,275
Other metal-grinding machines	44,364	35,729	59,700
Sheet and plate metal-working machines	139,846	101,186	144,506
Forging machinery	98,766	130,391	24,844
Rolling mill machinery	90,061	65,769	47,289
Foundry and molding equipment	32,958	28,815	16,475
Other power-driven metal-working machinery and parts	203,617	177,895	170,782

Other Metal-Working Machinery

Pneumatic portable tools	61,937	37,101	25,806
Other portable and hand or foot operated metal-working machines and parts	29,852	42,505	38,400
Chucks for machine tools	7,137	11,209	6,145
Machine operated pipe and thread cutters, stocks, dies, taps, and other machine-operated cutting tools	40,271	32,617	21,551
Other metal-working machine tools	26,961	19,202	21,588

ard equipment business is not appearing in volume at present. However, earnings of suppliers have made a much more satisfactory showing so far than the assembly plants.

Thomas Bradley is appointed director of purchases for Hupp; Wallace Zwiener, treasurer; while A. C. Rogers, former superintendent of the Hudson body plant, becomes a member of the manufacturing staff . . . Olds anticipates capacity production by December 15, adding some 3,500 employees in the meantime. . . . Steel inventories are not boosted because of unchanged first quarter prices.

Machine Tool Exhibit To Be Held Next Fall

Announcement has been made by the central office of the National Machine Tool Builders' Association that the 1935 Machine Tool Exposition will be staged at Cleveland. The dates of the exposition are September 11-21, inclusive, and the place is the Cleveland Public Auditorium. Applications for space are now being received at the office of the Association, 1220 Guarantee Title Building, Cleveland, Ohio.

Nominally on a three-year schedule this showing of metal-working and allied equipment, parts and materials is the first since 1929. In 1932 it was deferred because of adverse conditions in the capital goods industries and other considerations. With the results of six years' progress in design as a basis it is anticipated that the exhibition will surpass any previously held.

October Shows Rise in Foundry Equipment Orders

With an increase in orders of seventeen per cent, the foundry equipment industry looked decidedly brighter in October. The index of orders, as reported by the Foundry Equipment Manufacturers Association, reached 55.3 contrasting with 46.4 in September and 42.5 in October, 1933.

Shipments also rose with an index of 51.5 as against 37.0 the preceding month and 42.1 last year. Despite this rise, the index of unfilled orders also showed an improvement reaching 49.1 compared to 46.6 in September and 31.7 last October. The three months' average of gross orders advanced from 46.7 to 48.3 in October, which compares to 44.6 for 1933. Twenty-two members contributed to this report based on the volume of business for 1922-4.

Manufacturers Committee Prepares Platform for Recovery

In an attempt to answer the question, "What After NIRA?" a committee of the National Association of Manufacturers, headed by James W. Hook, president, the Geometric Tool Co., has included in its proposed platform for recovery a number of concrete suggestions. The recommendations offered by this committee will be presented for approval at the 39th annual convention of NAM and the Congress of American Industry to be held at the Waldorf Astoria Hotel, December 5 and 6.

A fundamental departure from present procedure is the recommended divorcing of fair trade practices from labor policies, both as to legislation and administration. The committee proposes that Congress enact legislation, at the expiration of the present NIRA, permitting continuance of the labor provisions in existing codes pertaining to child labor, minimum wages, maximum hours and collective bargaining, with clarifying definitions of collective bargaining and provision for more elastic working hours added.

The report points out that there is considerable doubt as to the constitutionality of federal regulations of local employment relations, other than for periods of emergency. It suggests, therefore, that since the emergency must end, appropriate state legislation be considered to apply in such cases. It further suggests that the federal measures proposed be administered by the Department of Labor and enforced by a court of competent jurisdiction.

Also at the expiration of NIRA, the committee proposes that Congress enact a temporary fair trade practice act which would permit any industry, trade or other representative group, voluntarily desiring to do so, to adopt and make effective a code of fair competition containing prohibition of unfair practices and submitting, if desired, provision for publicity of prices. Such legislation the committee contends should be administered by an independent administrative court of five members possessing the power to approve or disap-

• INDUSTRIAL REVIEW •

• Judging from the number of inquiries afoot, and from the reports of machinery salesmen on orders that are ready except for the final approval of the head of the company, machinery business pending is of considerable importance. Now that the end of the year is in sight and financial heads can get the business picture for the year, it is evident that many machinery building companies are going to show much better statements this year than last. While business is far from satisfactory it is enough better to be encouraging.

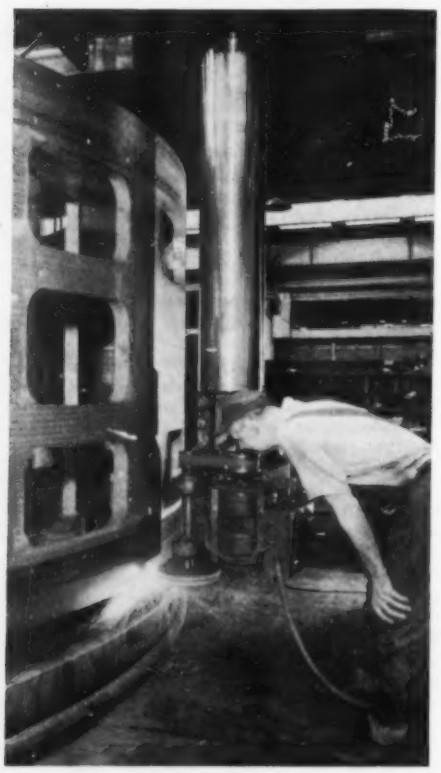
• Opening of the second group of ordnance machine tool bids this week was the center of interest for the Eastern distributors because the majority of the manufacturing arsenals are in the East. Otherwise a few orders are being taken and many inquiries are being figured on. Both orders and inquiries are better in Pittsburgh. One distributor believes that the situation is better than it has been for many months. Cleveland reports a continuing improvement in business and in employment. The newspapers there carried a record volume of advertising last Sunday.

• Buying of machine tools and equipment has tapered off in Detroit except for Ford orders which are being placed steadily. Supply business continues to increase. Toledo's automobile accessory shops are stepping up to be in readiness for the big orders expected this month. Some machine tool business has been placed to care for new items in the lines of producers. Accessory manufacturers in the Indianapolis territory have suffered loss of business caused by the transfer of Chrysler orders by reason of the decision of Chrysler to build all its own parts. Abandonment of knee action on Dodge and Plymouth has also restricted local activities. December does not look promising in Cincinnati as orders slacken. The volume of inquiries is considerable.

• In St. Louis machine tool demand is slight and automobile parts makers are less active than for some months. Supplies are in fair volume. Chicago distributors, on the contrary, have had some good business and more is in sight. They feel distinctly optimistic. Little change is reported from Milwaukee. There does not seem to be much prospect for equipment orders from the automobile industry. In the Northwest inquiries are active but almost entirely for used tools. San Francisco reports nothing of moment, both orders and inquiries remaining quiet.

prove codes of fair trade practices in interstate commerce. The standards by which the administrative court would be guided in rendering decisions should be established by Congress to prohibit injurious and destructive acts of competition. The act should be limited in its application to those industries that are engaged in or directly affect competition in interstate commerce.

While these codes are to be voluntary it is recommended that under appropriate safeguards the prohibitions submitted by the properly defined majority group of a trade or industry be binding upon the minority. In the absence of a majority request, the minority group should be likewise authorized to submit a code of its own, limited to its own members. Those industries or groups not submitting a code would continue to operate under the anti-trust acts and supplementary legislation. It is also suggested by the committee that to prevent confusion during the transition period after the expiration of NIRA and the development of codes under the new plan, that the existing competitive practice provisions be continued unless objection is made by a preponderant majority of an industry. The committee also voiced its belief that the supervision of labor is essentially a local problem.



***Finishing Touches on a 19-ft. Frame*—Because of hard molybdenum steel inserts a smooth tool finish could not be obtained on the 64,000 lb. casting illustrated. Shop executives at the East Pittsburg plant of Westinghouse found grinding to be the answer.**

Census Figures for 1933 Show Decline in Machine Tool Accessories

While over-all returns for the manufacture of machine tool accessories and machinists' precision tools and instruments, as reported in the Biennial Census of Manufactures for 1933, reflect a sharp drop from the 1931 figures, a study of these two years by quarters shows that conditions in 1931 were practically static but 1933 showed a marked improvement.

Wage earners, for example, averaged only 13,726 for the entire year in the latest report as against 17,533 in 1931 and 26,682 in 1929. However, considering the first quarter only, wage earners in this industry were down to 8,744 in 1933, approximately half of the 17,139 employed in the corresponding period of 1931. For the last quarter the 1933 figure had risen to 19,709 which was above the 17,075 for 1931.

The value of products turned out in this industry during 1933 was $44,383,246, a loss of 35.7 per cent from the 1931 figure which in turn was 52.2 per cent below 1929. For census purposes, this

Summary for the Industry:

	1933	1931	1929
Number of establishments	587	718	722
Wage earners (average for the year)[1]	13,726	17,533	26,682
Wages[2]	$14,159,642	$26,558,780	$51,084,540
Cost of materials, fuel, and purchased electric energy[2]	$10,910,288	$16,319,780	$26,992,631
Products, total value[2]	$44,383,246	$69,033,154	$144,410,890
Machine-tool accessories and machinists' precision tools and instruments	$36,830,801	$59,958,923	$134,273,247
Other products (not normally belonging to the industry) value	$4,930,202	$7,641,659	$7,832,392
Receipts for contract and repair work	712,166	1,432,572	2,305,251
Machine-tool accessories, etc., and products not normally belonging to the industry, not reported separately	$1,910,077	.....	.....
Value added by manufacture[3]	$33,472,958	$52,713,374	$117,418,259

[1]Not including salaried officers and employees. Data for such officers and employees will be included in a later report. The item for wage-earners is an average of the numbers reported for the several months of the year. In calculating it, equal weight must be given to full-time and part-time wage earners (not reported separately by the manufacturers), and for this reason it exceeds the number that would have been required to perform the work done in the industry if all wage earners had been continuously employed throughout the year. The quotient obtained by dividing the amount of wages by the average number of wage earners cannot, therefore be accepted as representing the average wage received by full-time wage earners. In making comparisons between the figures for 1933 and those for earlier years, the possibility that the proportion of part-time employment varied from year to year should be taken into account.

[2]Profits or losses cannot be calculated from the census figures because no data are collected for certain expense items, such as interest, rent, depreciation, taxes, insurance, and advertising.

[3]Value of products less cost of materials, fuel, and purchased electric energy.

Machine-Tool Accessories and Machinists' Precision Tools and Instruments—Production, by kind and value: 1933 and 1931

	1933	1931
Machine-tool accessories and machinists' precision tools and instruments, total value	$44,968,279	$74,551,254
Made in the "machine-tool accessories and machinists' precision tools and instruments" industry	36,830,801	59,958,923
Made as secondary products in other industries	8,137,478	14,592,331
Attachments and fixtures, total value	25,894,336	47,863,095
General equipment:		
Chucks	714,031	999,588
Vises (machine)	81,099	30,372
Attachments for machine tools:		
Lathe	103,721	200,168
Boring, drilling, and milling machine	804,637	1,430,153
Other machine-tool attachments	98,563	
Special equipment	22,500,685	43,108,037
Other attachments and fixtures	1,591,600	2,094,777
Small tools, total value	17,509,255	23,404,072
Arbors, collars, and collets (lathe, milling-machine, and drill)	164,477	192,051
Counterbores	56,093	323,358
Countersinks and combination countersinks and drills	104,399	193,336
Drills	4,508,073	4,897,421
Hobbing cutters	483,784	1,106,139
Milling cutters (all types), end mills, slotting cutters, etc.:		
Solid	2,446,673	3,325,522
Inserted-teeth	1,211,514	804,833
Reamers	1,220,359	2,145,377
Threading tools:		
Taps and dies (not pipe-threading)—		
Taps	1,847,588	2,382,554
Dies	641,534	856,010
Pipe threading tools:		
Taps	405,490	261,046
Dies	456,339	532,425
Pipe stocks complete with dies	649,890	1,083,890
Chasers	1,017,760	1,345,633
All other cutting tools, tool holders, mandrels, etc., and small tools, not reported separately	2,285,282	3,954,477
Precision measuring tools (micrometer and vernier)	185,868	2,074,922
Gages (plug, ring, snap, thread, etc.)	761,060	
Other measuring tools	617,760	1,209,165
Machine tool accessories, etc., and products not normally belonging to the industry, not reported separately (not included in totals at head of table)	1,910,077	.....

industry embraces establishments whose principal products are twist drills, reamers, milling cutters, taps, dies, etc., and those specializing in the production of dies, jigs, fixtures and special tools. Figures for 1933 are preliminary.

Houde Injunction to Test Collective Bargaining

WASHINGTON—A court decision may at last settle the long drawn out controversy as to the application of NIRA's Section 7a. Injunction proceedings were begun last week by the Federal Department of Justice against the Houde Engineering Corporation which will constitute the first court test of the collective bargaining provision of NIRA. It is predicted this suit will be the forerunner of court actions which will be carried to the Federal Supreme Court.

The issue involved is whether the majority of the employees of an industrial plant has the right to speak for all. This much disputed point has been variously interpreted by the President in his automobile strike settlement, by General Johnson, when National Recovery Administrator, and by Donald Richberg. However, the Labor Relations Board has ruled that the majority has the right to speak for all and upon this ruling the suit is based.

Possibility of Further Regulation Still Makes Business Hesitant

WASHINGTON—Abusive criticism by Secretary Ickes of the indolence of private capital has greatly embarrassed President Roosevelt by casting doubt on the sincerity of the administration's pledge to retire from the normal field of private initiative as rapidly as business takes up the slack in the recovery program. While the administration is prepared to move in, if it develops that business is only stalling for time until 1936, Mr. Ickes' jumped the gun. While the President's reprimand of his Secretary of the Interior was prompt, this lack of teamwork in the administration does not inspire the confidence necessary to encourage business that it can make a profit without fear of government competition.

The silver bloc demands retirement of tax-exempt bonds with new money backed by Treasury stocks of gold and silver, but the President stands firm for reserving the gold profit for an emergency, which may be a hint that the administration as well as business is looking ahead to 1936.

The administration wants lower money rates and the thought is that investors will be satisfied with, say 5 per cent, if risks are insured. This idea is now being tested in home mortgage financing and its extension to plant improvements already has been proposed.

Secretary Roper's statement that no government can stand on the policy of increasing unemployment is significant; that is what happens when the dole becomes preferable to wages. Realizing that business is not yet able to support a recovery program and at the same time provide "economic security," for its employees by an elaborate system of social insurance, President Roosevelt has in effect deferred the latter phase of his plans. Hopes inspired by his message to Congress last Spring will not readily be relinquished, but the fight of the "social lobby" in Congress may result only in blocking the foundation for unemployment insurance which President Roosevelt desires to lay, but which is as far as he is now willing to go.

More patchwork by ICC increases rail rates on long hauls, shades rates on short hauls of merchandise freight in the west and raises rates between east and west. Thus does the Commission attempt to repair the damage done by "scientific scales" which invited truck competition on short haul freight and deprived them of revenue on long haul freight which they can still call their own. The Commission's finding that the western roads have sustained their claims for need of increased revenues augurs favorable consideration of the pending petition for general increases in freight rates throughout the country, with due allowance for highway competition on short hauls.

The Federal Emergency Relief Administration's abandonment of 30 cents an hour as the minimum wage rate for common labor on the relief projects was in response to wide-spread protests that this is higher in many communities than the prevailing rate. The 30-cent rate was adopted following termination of the CWA program last Spring in which common labor was paid the zone rates of 45 and 50 cents an hour. Henceforth, workers on relief projects will be paid the prevailing rate as determined by local committees representing labor, business and the local relief administration. Skilled labor engaged on relief projects has been paid the prevailing rates for some time.

German Machine Building Industry Improves

According to a report from Vice-Consul J. H. Wright, made public by the Commerce Department, increased domestic business has appreciably improved the position of Germany's machine-building industry. As a result of the German government's industrial recovery and reemployment program, German industry as a whole revived during 1933, but until recently this was not strongly felt in the German machinery industry. At the beginning of 1933 the production was at 30.5 per cent capacity and reached only 34.8 by the middle of the year. By the middle of 1934 production reached 57 per cent of capacity.

Orders so far in 1934 are equal to about 83 per cent of the 1928 level, compared to 26 per cent of the 1928 level during February 1933. Total orders have increased from 30 per cent of the 1928 level during the early part of last year to 69 per cent at present.

It is the belief that without additional investments, current replacements by various branches of the German industry would be sufficient to keep the German machinery building industry occupied on a satisfactory level for some time to come. The principal factors mitigating against improvement in the German machinery export trade have been competition from countries with depreciated currencies and the increase in the manufacture of machinery in former important markets. British and American competition is growing steadily stronger. German machine building industry has come to realize that its exports in the future will have to be confined more and more to special machinery.

Navy Awards Submarine Machinery Contracts

Six sets of propeller machinery for the new design submarines being constructed under the 1934 program were recently awarded for the total sum of $3,948,144. The Winton Engine Corporation was awarded a contract for furnishing three of these sets for submarines under construction by the Electric Boat Co. Two of the sets went to the Fairbanks, Morse Co., for use in the submarines being built at the Portsmouth, N. H., Navy Yard.

As a result of the opening of bids held in the Navy Department on November 27 the contract for the last set of propelling machinery was awarded to the Hooven-Owens-Rentschler Co. for the sum of $1,190,000 with electrical equipment supplied by the Allis-Chalmers Manufacturing Co. This submarine is building at the Navy Yard, Mare Island, Cal.

• PATENTS •

November 13, 1934

Metal-Working Machinery

Pressure Die-Casting Machine with Device for Uniformly Controlling the Movable Parts by Means of Gaseous and Hydraulic Pressure Media. Paul Haessler, Nuremberg, Germany. Patent 1,980,333.

Metal Cutting Machine. Leo C. Shippy, Alva W. Phelps, and John Q. Holmes, Anderson, Ind., assigned to General Motors Corp. Patent 1,980,359.

Feed for Automatic Machine Tools. Harry W. Rupple, Shaker Heights, Ohio, assigned to the Cleveland Automatic Machine Co. Patent 1,980,440.

Method and Means of Producing Hobs. George R. Scott, Norfolk, Va. Patent 1,980,444.

Method of and Device for Producing Conjugate Worm Gearings. Heinrich Schicht, Huckeswagen, Germany, assigned to W. Ferd. Klingelnberg Sohne, Remscheid-Berghausen, Germany. Patent 1,980,554.

Metal Working Machine. Arthur F. Hanson, Philadelphia, Pa., assigned to Budd Wheel Co. Patent 1,980,584.

Grinding Machine. Robert E. W. Harrison, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,980,682.

Apparatus for Grinding. Arthur F. Moul, Buffalo, N. Y., assigned to Samuel C. Rogers & Co. Patent 1,980,872.

Tools and Attachments

Leader Pin. Emil A. Baumbach, Chicago, Ill. Patent 1,980,174.

Machine Tool Attachment. Nils Berglund, Springfield, Mass., assigned to United American Bosch Corp. Patent 1,980,178.

Chuck Retaining Means. Frank O. Hoagland, West Hartford, Conn., assigned to Pratt & Whitney Co. Patent 1,980,336.

November 20, 1934

Metal-Working Machinery

Milling Machine. Walter D. Archea, Cincinnati, Ohio, assigned to the Cincinnati Milling Machine Co. Patent 1,981,216.

Turning Machine. George F. Yager, Toledo, Ohio, assigned to the Bunting Brass & Bronze Co. Patent 1,981,260.

Machine Tool. Hiram D. Croft, Springfield, Mass., assigned to Perkins Machine & Gear Co. Patent 1,981,263.

Automatic Die-Casting Apparatus. Karl Friedrich Wagner, Stuttgart, Germany, assigned to Magnesium Development Corp. Patent 1,981,380.

Means for Assuring the Safe Working of Automatic Pressure Die-Casting Apparatus. Karl Friedrich Wagner, Stuttgart, Germany, assigned to Magnesium Development Corp. Patent 1,981,381.

Machine Thread Miller. Andrew Haxton, Tappan, N. Y. Patent 1,981,550.

Gear Testing Apparatus. Floyd A. Firestone, Ernest J. Abbott, and Harvard B. Vincent, Ann Arbor, Mich. Patent 1,981,693.

Tools and Attachments

Tool for Grinding or Lapping Cylindrical Bores. Paul E. Wagner, Detroit, Mich., assigned to Hutto Engineering Company, Inc. Patent 1,981,258.

Processes

Forging Tapered Articles. John D. Pugh, Baltimore, Md. Patent 1,981,326.

November 27, 1934

Metal-Working Machinery

Method of and Machine for Producing Gears. James E. Gleason and Edward W. Bullock, Rochester, N. Y., assigned to Gleason Works. Patent 1,982,050.

Spindle Mounting. Lester F. Nenninger, Cincinnati, Ohio, assigned to the Cincinnati Milling Machine Co. Patent 1,982,265.

Grinding Machine. Frederick S. Haas, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,982,297.

Grinding Machine. Frederick S. Haas, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,982,298.

Grinding Machine. Emil Ritz, Jr., Mount Healthy, Ohio, assigned to the Hisey-Wolf Machine Co. Patent 1,982,483.

Nut Blanking Machine. Samuel Baxendale, Detroit, Mich., assigned to the Modern Collet & Machine Co. Patent 1,982,492.

Tools and Attachments

Sizing Device for Grinding Machines. Daniel Gurney, Waynesboro, Pa., assigned to Landis Tool Co. Patent 1,982,161.

Hold-Down Plug for Punch Presses and the Like. John A. Weber, Detroit, Mich. Patent 1,982,488.

• OBITUARIES •

CHARLES O. BARTLETT, who with K. F. SNOW founded in 1885 the C. O. Bartlett & Snow Co., Cleveland, Ohio, manufacturer of heavy machinery and foundry equipment, died Nov. 28 at the age of 85. Mr. Bartlett was president of the company until 1922.

JOSEPH V. GRANDINETTI, 50, president of the Grandinetti Mfg. Co., manufacturer of food machinery and equipment, Syracuse, N. Y., died at his home in that city on Nov. 28.

PLINY E. HOLT, recently vice-president and chief engineer of the Caterpillar Tractor Co., died Nov. 18 at the age of 62. As chief engineer of the Holt Manufacturing Co., of Stockton, Calif., he became connected with the Army Ordinance Corps in the war and developed a one-man tank for which he became well known.

HARRY U. MORTON, president of the Morton Manufacturing Co., Chicago, Ill., manufacturer of railway appliances, died recently. He organized the company in 1913.

• BUSINESS ITEMS •

The Harnischfeger Corp., Milwaukee, entertained 1,000 visitors at its fiftieth anniversary on Nov. 17. At the celebration were shown four 300-ton electric cranes built for the United States government for installation at Boulder Dam. Other products of the company were exhibited.

The DeVlieg Milling Machine Co., Jackson, Mich., has appointed the Cadillac Machinery Co., Detroit, as representatives in that territory.

• PERSONALS •

ROBERT M. EAMES, vice-president and general manager of the Bryant Electric Co., Bridgeport, Conn., has resigned. HARRY E. SEIM, treasurer succeeds Mr. Eames.

HOWARD U. HERRICK, formerly president of the V & O Press Co., Hudson, N. Y., became vice-president on Dec. 1 of the E. W. Bliss Co., Brooklyn, N. Y. and Toledo, Ohio.

RAYMOND J. KOCH, treasurer and secretary of the Felt & Tarrant Mfg. Co., manufacturers of calculating machinery, has been made president to succeed the late WILLIAM F. BABCOCK.

HARRY A. MEYERS, formerly vice-president of the Dean Machinery Co., 80 East Jackson Boulevard, Chicago, has been elected president to succeed R. S. DEAN, who resigned several months ago. HARRY A. LYON has been elected vice-president.

JOHN A. VOLAND, secretary and assistant manager of the Golden Anderson Valve Specialty Co., Pittsburgh, Pa., has been elected president and general manager, succeeding the late C. E. GOLDEN.

• MEETINGS •

AMERICAN ENGINEERING COUNCIL. Annual meeting, Jan. 10-12. Washington, D. C. FREDERICK M. FEIKER, executive secretary, 744 Jackson Place, N. W., Washington, D. C.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Annual meeting, Dec. 4-6, at the headquarters of the society, Enginering Societies Bldg., 29 West 39th St., New York, N. Y.

NATIONAL ASSN. OF BOTTLING MACHINERY MANUFACTURERS. Annual meeting, Jan. 14. Hotel Statler, Buffalo, LOUIS B. MONTFORT, secretary, 218 Munsey Bldg., Washington, D. C.

NATIONAL ASSOCIATION OF MANUFACTURERS. Annual meeting, Dec. 5-6. Waldorf-Astoria Hotel, New York. WALTER B. WEISENBURGER, executive vice-president, 11 West 42nd St., New York, N. Y.

POWER SHOW. Eleventh national exposition of power and mechanical enginering. Dec. 3-8. Grand Central Palace, New York. CHARLES F. ROTH, manager, Grand Central Palace.

SOCIETY OF AUTOMOTIVE ENGINEERS. Tractor and industrial power equipment meeting, Dec. 5-6. Stevens Hotel, Chicago. Thirtieth anniversary dinner, Jan. 7. Hotel Commodore, New York. Annual meeting, Jan. 14-18. Book-Cadillac Hotel, Detroit. JOHN A. C. WARNER, secretary, 29 West 39th St., New York.

SHOP EQUIPMENT NEWS

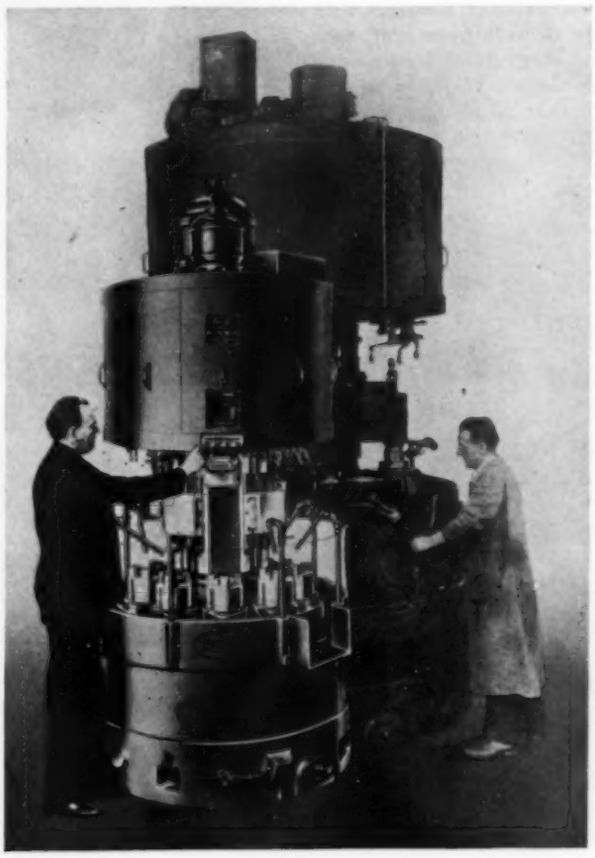
Bullard J-Series Mult-Au-Matics

The Bullard Co., Bridgeport, Conn., has announced a series of Mult-Au-Matics known as the "J Series" for the smaller classes of work. These eight-spindle machines are built in two sizes, "J-7" and "J-11." Combined electrical and mechanical functions provide flexibility to changeover from one job to another in tool setting and in operation. Three push-button control stations provide ease and safety of tool setting as well as machine operation. Each unit has four separate buttons, one for emergency control which stops all functions; a second for starting the main drive motor; a third for head traverse advance, and a fourth for head traverse return. The latter two functions are operated from a small separate motor.

The eight spindles allow one station for chucking and seven stations for working with the speeds independently variable to meet the requirements at any station. The initial range for the "J-7" machine runs in 41 changes from 168 to 1509 r.p.m. For "J-11" the initial range in 41 changes extends from 84 to 754 r.p.m. In addition to these changes and by means of a dual range change feature it is possible to obtain a 2 to 1 reduction on all spindles. Because of the high spindle speeds and the rapidity of indexing, these machines are designed with synchronizing mechanisms for the synchronization of the spindle and spindle drive gears at the time of re-engagement after indexing.

The seven feed works brackets are cast integral with the feed works base. This construction forms a single compact unit that dampens vibrations. However, the seven screw type feed works operate individually and independently for each work station. Adjustments are provided so that short or long feed strokes may be obtained. Total maximum stroke is 10 in. This combines traverse and feed which, within certain limits, may be divided into various combinations to suit the work specifications. The limiting factors of traverse and feed are the minimum traverse stroke of 1⅜ in. and the minimum feed stroke of ¼ in.

Capacities of the J-7 and J-11 are 8 and 12 in. in diameter, respectively, with a height of 10 in. Chucks are mechanicallly power operated and are of the 3-jaw universal type, 6¾ in. in diameter and 10¾ in. in diameter, respectively, to grip 5 in. and 8¾ in. Jaw pressures are adjustable. Feeds per revolution of spindle are the same for both machines and range in 41 changes from 0.004 to 0.036 in. Tool heads of two types are obtainable. The plain vertical tool head is of one-piece construction and has a 10-in. vertical movement only. The plain compound head is comprised of a single tool-slide mounted on the saddle. The total stroke of this slide is 10 in., which may be applied as vertical movement only or to include the maximum 1½ in. movement of the tool slide to either the right or left. Height of both machines from the floor is 102 in.



Trent Type MP Electric Solder Melting Pot

The Harold E. Trent Co., 618-640 N. 54th St., Philadelphia, Pa., has brought out an improved model of its MP-45 lb. electrically heated bath for tin, solder or hard melting work. The prin-

cipal changes consist of an improved design of switch and plug box to facilitate connecting to a circuit. A complete change has been made in the design of the electrical heating unit. Instead of the unit being clamped to the pot, strip units are used with both sides smooth and free from joints or corrugations. These units are pushed into two tubes cast into the bottom of the pot, obtaining better heat conductivity and longer life.

Hutto Gear Lapping Machine

A gear lapping machine utilizing the "inclined axis" principle has been developed by the Hutto Engineering Co., Inc., 515 Lycaste Ave., Detroit, Mich. The axes of the lapping members are inclined to the work piece in such a manner that the normal line of rolling contact is transferred from one parallel to the axis of the work piece to one which diagonally intersects the conventional pitch line. This inclination of the lapping members results in the transference of the attendant sliding action, both above and below the transferred line of rolling contact, and subjects the conventional pitch line to a sliding action from the point of intersection, or the transferred line toward the face extremeties of the gear tooth flanks. In this manner, frictional or abrasive action is produced along the normal pitch line of the gear tooth by rotary motion only. This is accomplished without increasing the sliding movement between the other contacting portions of the gear teeth.

The gear lapping machine is automatic in operation and may be had with the variable rotating speeds and adjustable reciprocating stroke controlled through an electrical timing device. The "crowned" tooth faces may be produced, as well as "straight" tooth faces because the machine employs a comparatively slow longitudinal reciprocating motion solely for the purpose of distributing the abrasive effect over the face of the gear teeth.

Fig. 2 shows the application of the inclined axis method of engaging the work piece gear with two lapping members. The two lapping members are employed at diametrically opposite sides of the work piece in combination with a supply of suitable abrading material. The driven lapping member, through engagement with the work piece which is in turn driven by the driving lapping member, is retarded through a braking means. Pressure is thus brought to bear upon opposite flanks of the work piece to assure the desired lapping effects. Because the axes of the lapping and working members lie in a common plane, the inclined axial engagement of two or more geared members for gear lapping purposes is suited to engagement of multiple lapping members with a multiple type of work piece gear, such as cluster or herringbone gears, and makes possible the simultaneous lapping of two or more gear members.

National Acme Circular Chaser Dieheads for B&S Automatics

A line of self-opening dieheads for Brown & Sharpe automatics has been developed by the National Acme Co., Cleveland, Ohio. These dieheads may be had either with milled or ground-thread circular chasers. The tools are the pull-off type with safety release. The parts are interchangeable. Chasers are mounted externally to the head so that the cutting action does not take place inside of the diehead proper. Chips are thrown outward and do not interfere with the free operation of the diehead parts, thus making it possible to thread close up to a shoulder. Either straight or tapered threads in a wide variety of thread forms may be cut.

When the chasers are dull, the removal of one screw permits the oper-

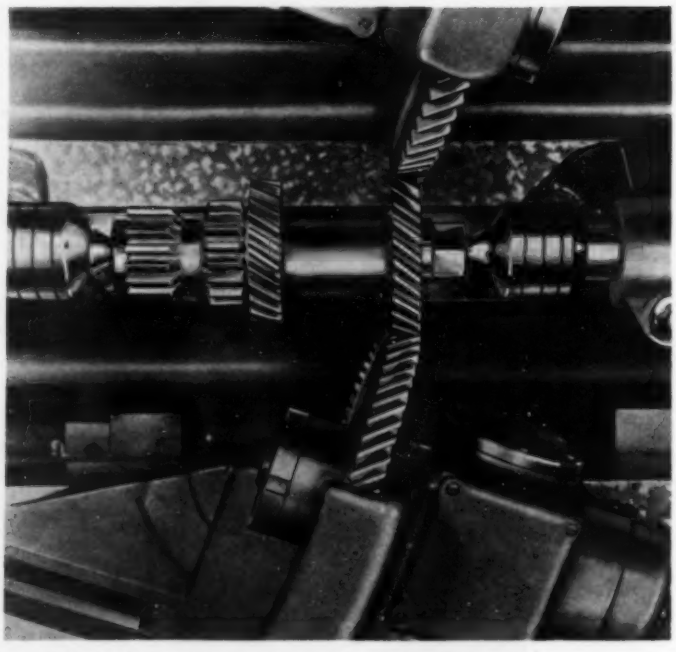


Fig. 1—Hutto Gear Lapping Machine through use of which one or members of a cluster gear can be lapped at once. Fig. 2—Application of the "inclined axis" principle is clearly shown

ator to slip each block with its chaser out of the head. A sharpened set can be slipped into place and operation resumed in a few moments. Each chaser is essentially a circular forming tool and has a heavy body of metal back of the cutting edge to carry away the head of cutting. An advantage is the fact that the chaser can be ground repeatedly until the entire periphery has been used up. The same chaser may be used either right or left-hand by changing the chaser from a right- to a left-hand chaser block and grinding on the opposite face of the chaser.

These dieheads are made for all sizes of Brown & Sharpe automatics and have a minimum cutting capacity of 0.056 in.

"Economax" Upright Drilling Machines

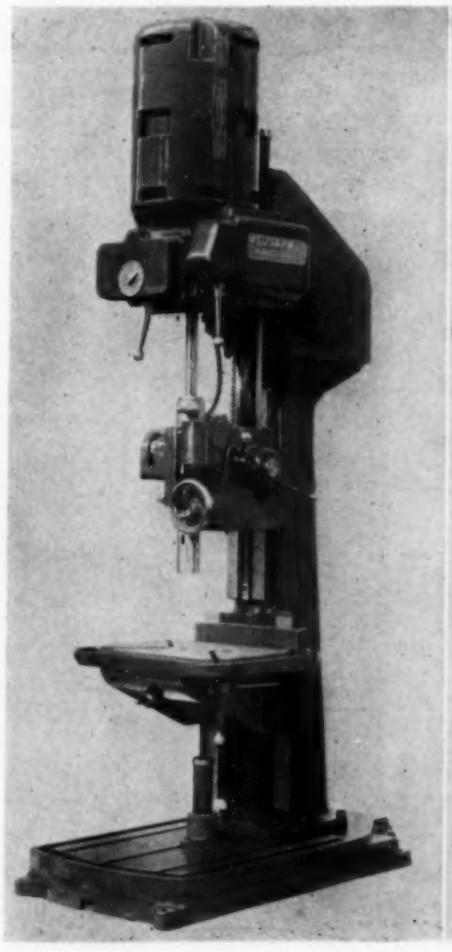
The Fosdick Machine Tool Co., Cincinnati, Ohio, is offering three models of "Economax" upright drilling machines as follows: A motorized-spindle type having a box column, a box-column model with the motor on a bracket at the rear of the head, and a round-column model which likewise has the motor mounted on a bracket at the rear. The motorized-spindle type is shown in the left-hand illustration, and the round-column model in the right-hand illustration. The three sizes are 21, 25 and 30 in.

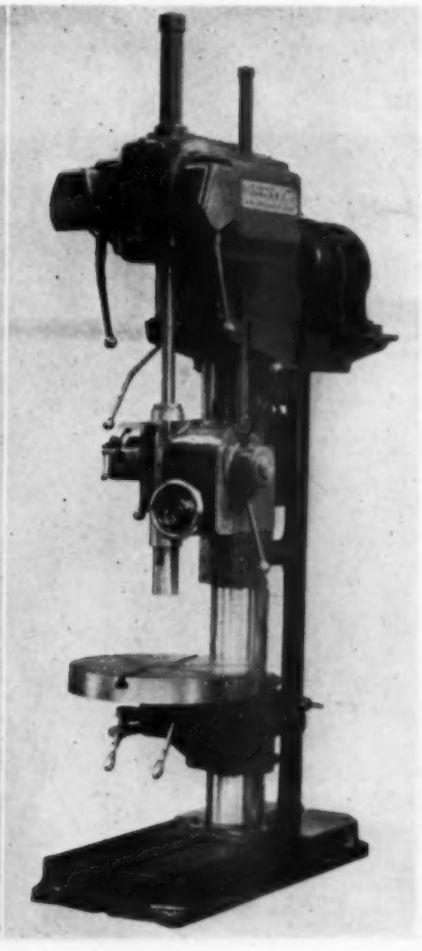
The speed box has twelve speeds in geometrical progression from 60 to 1500 r.p.m., and these speeds can be obtained by a single lever while running. The speed change lever shows the exact speed of the spindle for each position. Twelve gears are employed in this transmission unit and are of the selective sliding type. The spindle is multiple-splined and is driven by a long alloy steel, heat-treated sleeve which extends completely through the gear housing to prevent oil from escaping through the splines and down the spindle. The spindle nose has a No. 4 Morse taper. Rack teeth are cut directly in the spindle sleeve, bringing the pressure of the feed closer to the center of the spindle and allowing for a wider faced pinion.

Drive from the motor goes directly through the pinion and gear to the start, stop and reverse multiple-disk friction clutches. These clutches are ball-bearing mounted on a multi-splined horizontal shaft to eliminate chatter.

Nine feeds are supplied and are controlled by a single-lever with direct-reading index. The range is from 0.005 to 0.043 in. per rev. of the spindle. All gears are of the sliding type. The positive feed clutch provides accurate tripping at a pre-determined depth. After the feed is tripped the spindle can be advanced by hand for the remaining travel. An adjustable positive hand stop, which can be set by a direct-reading graduated dial, is supplied for accurate spot facting, counter-boring or gap drilling. This hand stop can be used for work where more than two depths are required. Automatic trips disengage the feed at both ends of travel.

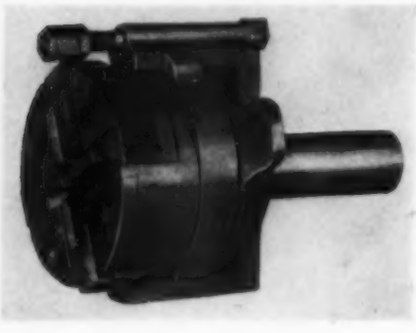
The motorized spindle upright drill is designed to meet demands for single-purpose operations, but can be used for general drilling. Any number of spindle speeds from 1 to 8 can be obtained in a range of 75 to 1800 r.p.m. One to nine feed changes can be had with a range of 0.005 to 0.043 in. per rev. Larger feeds can be had. All speed and feed changes are obtained by means of single levers. Reverse to the spindle for tapping is accomplished through a reversing switch located on the sliding head.





H & G Inserted-Chaser Diehead for No. 0 B&S Automatics

The Eastern Machine Screw Corp., New Haven, Conn., has developed a diehead for the No. 0 Brown & Sharpe automatic to use inserted chasers. The diehead illustrated is known as the No. 101 size of the Style DM. It is equipped with both adjustable pull-off trip and adjustable head-end trip, the latter being of advantage on close-to-shoulder threading. Furthermore, it is equipped with an improved "double arm drive shank" which takes the torque at a



maximum distance from the center and reduces the friction of pull-off considerably.

The capacity of the diehead is as follows: up to and including 3/8 in. diameter, a thread length of 3 3/8 in.; up to and including 7/8 in. in diameter, a thread length of 1 1/8 in.; up to and including 3/4 in. in diameter, a thread length of 1 1/8 in. The capacities enlarge the threading possibilities on the No. 0 B&S automatic. Another feature is that the diehead uses the same chasers as the H&G insert chaser dieheads for the No. 2 B&S, 7/8 in. and 1 1/4 in. multiple spindle machines.

Norton Type C 6-In. Grinder

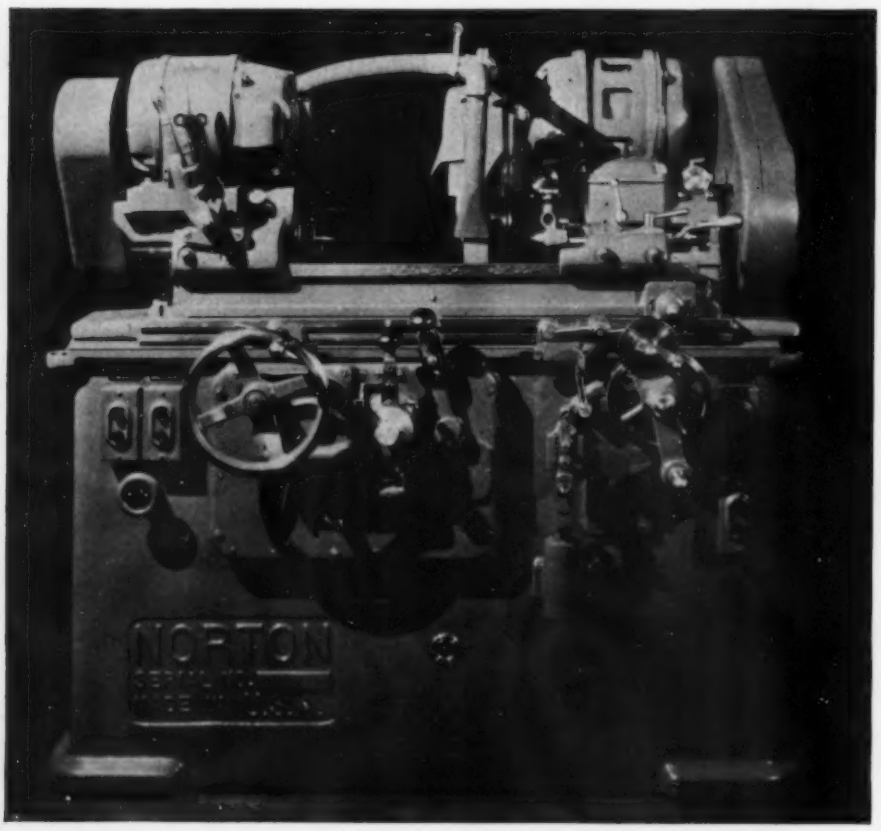
The Norton Co., Worcester, Mass., has added a 6-in. size to its Type C line of cylindrical grinders. This machine has a nominal swing of 6 in. and is built in either of two lengths taking 18 or 30 in. between centers. Patterned after the 10 in. and 16. in Type C machines, this 6 in. model has a self-contained wheel unit and uses a standard 20 in. diameter grinding wheel. The wheel spindle is driven by V-belts direct from the motor without idlers or intermediate shafts. Spindle bearings are made of hard bronze and are flood lubricated with filtered oil. Spindle reciprocation is optional.

The work carriage consists of a sliding table traveling in a V and a flat way in the base and supports a swivel table pivoted to it at the center. The headstock, footstock, steadyrest, center pointer and radial truing device are clamped to the swivel table. The headstock is driven by an adjustable-speed d.c. motor to provide a wide range of work speeds. In addition, a lever which operates a clutch and brake, is provided. This lever is now arranged vertically instead of horizontally.

Power traverse machines are hydraulically propelled, the oil pump and the driving motor being an integral unit mounted within the base. Reverse and throttle valves are of the design used on larger Norton Type C machines. The table is traversed by a double rodded piston connected to each end with a quick-acting latch. This piston travels in the cylinder attached to the base, and table speeds from 7 to 360 in. per min. are available. The quick-acting latches permit disconnecting the piston altogether, thus affording a means of operating the table by hand.

For plunge-cut operations only, a hand traverse unit is substituted for the power traverse elements. This unit has a slow speed for wheel truing and a fast speed for moving the table into the grinding position. Change from one to the other is made by means of a knob on the hand wheel. Both hand and power traverse machines can be equipped with a hydraulically operated wheel head traverse unit. This unit moves the wheel head rapidly in and out between grinds for as much as 3 in. if required.

The 30 in. machine weighs 4700 lb. complete with all motors and standard equipment, and requires a floor space of 4 ft. 9 in. by 9 ft. 4 in.



Ingersoll Type NB Face Milling Cutters

Heavy-duty face-milling cutters for use on cast iron and steel are being marketed by the Ingersoll Milling Machine Co., Rockford, Ill. The Type N B cutters have the following features: a 13/16 in. cutting edge on the periphery for deep cuts; a 1-in. cutting edge on the face to insure a good finish; a 1 1/4 in. blade projection beyond the face of the housing for chip clearance, and serrated blades so that the full depth of cut can be taken without blade movement though 60 per cent of the blade has been used.

Standard N B cutters are furnished from 8 to 16 in. in diameter. Two optional designs are available: spindle noses made either to the National Standard for planer type milling machines; or to the National Standard for knee type milling machines. All cutters have

Ingersoll Type NB Face Milling Cutter for general milling cuts up to 3/4 in. deep in cast iron or steel

keyways 1 in. wide by 1 in. deep and are driven by two radial keys. Each blade is held in position by a hardened wedge locked in place by a hollow head capscrew. Removal and adjustments can be made without damage to the housing, wedges or screws. The body or housing is an alloy steel forging.

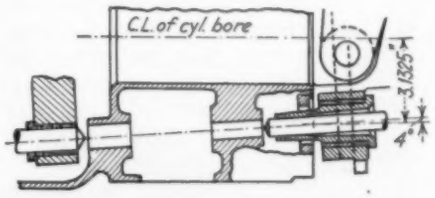
Baker No. 50-HH Two-Way Hydraulic Machine for Valve Bores

Baker Bros., Inc., Toledo, Ohio, has furnished equipment illustrated for drilling the valve guide and tappet holes in a 6-cyl. motor block of a 1935 car. A second machine is used for two-way boring of the same holes. This second machine is tooled with the same heads and fixtures except the tools used are of the multiple-blade, end cutting type. The operations performed are shown in the sectional view. The holes are at an angle relative to the main bores.

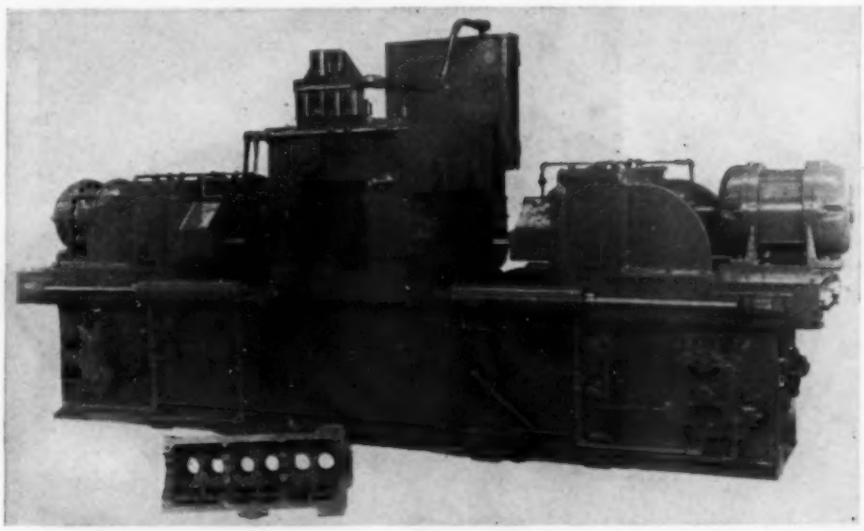
The basic machine is of standard design with a one-piece bed with finished ways of 24 in. total width. An oil pump is incorporated in the bed at each end. The improved pumps are bolted to the bed with individual drive motors also inclosed in the bed. By mounting the two oil pumps, one at each end, there is provided an independent hydraulic feed system for each opposed head. The driving motors are accessible. The "Twin-Pull" feed cylinder mounting is used for movement of each saddle. Cylinders are 3¾ in. bore to give an available feed pressure of 18,500 lb. to each head. Rapid traverse speeds forward are 220 in. per min.; rapid return, 180 in. per min. Multiple-spindle heads are mounted to the drive brackets on saddles 40 in. long.

The fixtures are of the tunnel type with provision for the use of tumble-type conveyors to facilitate rapid handling of the block into and out of the fixture. The block is chucked on the side, locating from two dowel pins in the pan rail surface. Clamping is done hydraulically with the auxiliary under-supports at each end of the block. Tool-support bushing plates are mounted on the fixture and are moved in and out through the action of an oil cylinder. The support bushings are accordingly close up to the work at the start of the cuts. The two levers at the upper left of the fixture control the clamping and moving of the support plates.

The machine is automatic in cycle and all controls are placed conveniently for the operator. A separate hydraulic system is furnished for the fixture operations.



Sectional view of the block showing that the holes are at an angle in relation to the main bores



Baker No. 50-HH Two-Way Hydraulic Machine for drilling the valve guide and tappet holes in a 6-cyl. 1935 motor block. A second machine bores the same holes

Star Test-Plier

A combination tool that permits removal of fuses and the testing of open-circuited or grounded parts has been placed on the market by the Star Fuse Co. Inc., 235 Canal St., New York, N.Y. The illustration shows the pliers testing across a switch for locating blown fuses. The tool is made of bakelite and laminated fiber. It is insulated throughout. The testing indicator is a carbon lamp. Shocks are avoided as only one hand is used in testing.

Lincoln Shielded-Arc AC Welder

The Lincoln Electric Co., Cleveland, Ohio, has developed an a.c. welder of the motor generator type. This machine takes two-phase or three-phase current of standard voltages and frequencies and converts it into alternating current of lower voltage and at the higher frequency most suitable for arc welding, with either heavily coated or washed electrodes and in all positions. The improved arc characteristics are due to the higher frequency which affords more

stable arc, less magnetic blow and easier starting of the arc. The weld metal is improved since there is less spatter loss and greater density in multiple-pass welding. Since the machine takes power from all phases instead of only one phase, better power characteristics from the line result.

The shielded arc a.c. welder is built in portable and stationary motor-driven models in two sizes. The smaller capacity machine can be used for continuous welding with electrodes of $\frac{1}{32}$ to $\frac{1}{16}$ in. in size, and the larger welder handles electrodes from $\frac{1}{8}$ to $\frac{3}{8}$ in. in size. These machines are wired for 220, 440 or 550 volts, a.c., 2 or 3 phase, 50 and 60 cycles.

Producto-Matic No. 51 Planetary Milling Machine

The Producto Machine Co., Bridgeport, Conn., has developed a "Producto-Matic" miller, having two vertical columns, each column carrying two cutter spindles. The machine is designed to perform planetary milling operations; that is, the work revolves around the cutter to produce the surface required. Illustrated are the different types of yokes used in automobile universal joints. The operation is to mill two grooves and two concentric surfaces with the cross-hole on both arms of the forgings. The machine is not limited to this particular job, but can be used generally for planetary milling operations.

The machine has two vertical columns carrying spindles and two work bases, one under each column. The only function of the vertical position of the cutters is to bring these cutters into work for milling and out of the way for convenience in loading and unloading the fixture. Vertical travel of the cutter spindle assembly is made through a drum cam mounted within the housing. Each set of cutter spindles is driven by an independent 1-hp. motor. An automatic switch is provided to stop the revolving cutters during loading and unloading for the operator's convenience.

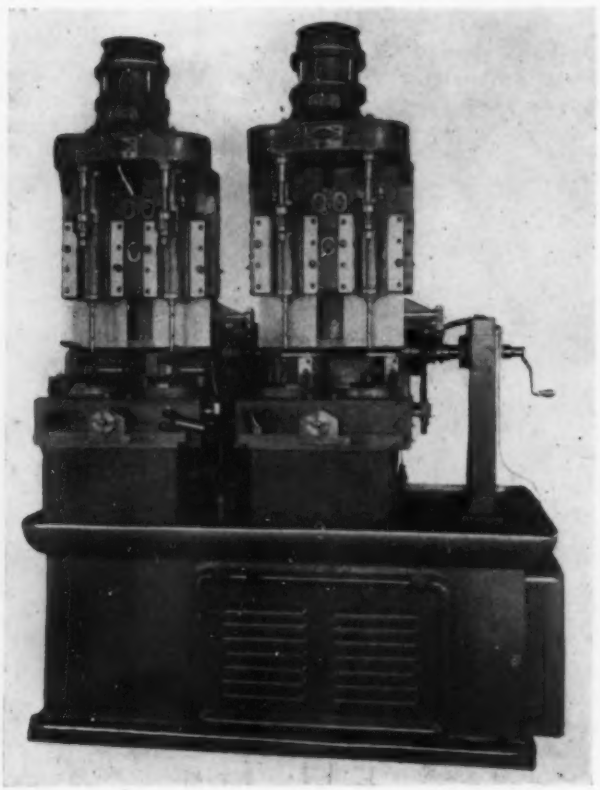
Each work fixture table has two distinct movements. In the first a lateral travel is made to set the work in relation to the cutters for the correct depth of milling. The second movement provides for the work fixture to make a complete circular movement to finish the cut. The whole work fixture base can also travel laterally to bring the work and fixture away from the cutters for easy loading. Feeding mechanism is driven by a 5-hp. motor.

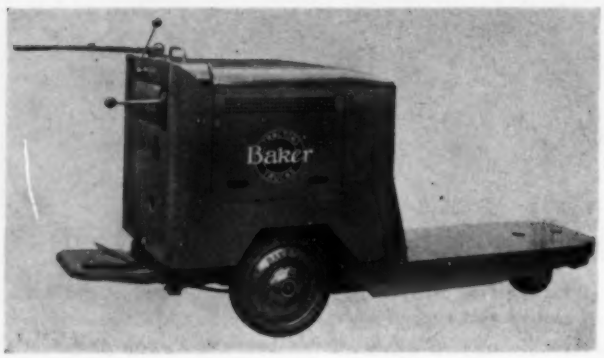
"Clarktor-6" Industrial Tractor

The Clark Trucktractor Co., Battle Creek, Mich., has developed a "Clarktor-6" industrial tractor with a 46 hp., 6-cylinder power plant. The light model is used for general industrial applications. Heavy duty transmission and special gear ratios in the double-reduction rear axle make a wide range of speeds available to handle various types of service at speeds as high as 18 m.p.h. This is of importance in industrial plants covering large acreage. All models have a self-starter, generator, battery, horn, bumper plate, eye coupler and pnuematic tires.

Baker 3-Ton Elevating Truck

A two-wheel drive, four-wheel steer, 2-ton elevating truck has been developed by The Baker Industrial Truck Division, the Baker Raulang Co., Cleveland, Ohio. A "streamlined" inclosure for the battery box and controls improves the appearance and increases the safety for the operator, besides increasing the accessibility of many parts. Other features are an electrically welded frame of high carbon steel, alloy steel trailing axle, larger travel brake than on previous models, roller bearings on top and





bottom of steering mast and needle bearings in many of the steering rod connections for increased ease of steering. The lifting unit employs roller chain working on hardened steel sprockets. Both upper and lower limits of operation are protected by a limit switch. Three speeds forward and reverse are supplied with the truck. Standard platforms are furnished in lengths from 55 to 84 in. Standard height is 11 in. while the width is 26½ in.

Ex-Cell-O Cemented-Carbide Grinder and Finishing Machine

A grinder and finisher for cemented-carbide tools has been developed by the Ex-Cell-O Aircraft & Tool Corp., 1200 Oakman Blvd., Detroit, Mich. This machine utilizes the new molded diamond wheels. Grinding checks and cracks are eliminated because the generated heat is controlled. Surface is ground to final finish and not polished down. An inbuilt ¾-hp. motor drives the two diamond wheels, the spindle being mounted in Ex-Cell-O ball bearings. Water can be supplied to the wheels by means of an electrically driven water pump at the rear. Tool support tables at each end of the machine are provided with hardened and ground strips to form a smooth surface table. Graduated adjustments on each table provide a method of maintaining the correct rake and angle for each tool. Suitable tool holders can be provided for sharpening boring tools and similar round shank tools.

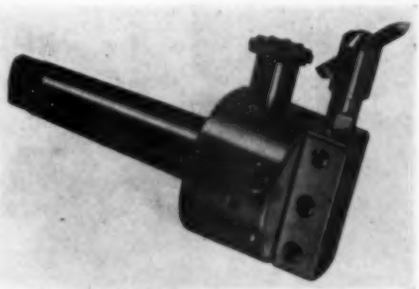
A large guard covers the spindles and wheels as shown in phantom. Each end of the guard is left open to allow the operator complete freedom to use the entire length of the table. Sliding doors in the guard at both the front and the rear of the machine permit the operator to hold the tool parallel with the face of the wheel when required. Suitable adjustable water guards are provided at each end of the machine.

Craley Boring, Turning and Facing Head

The C. C. Craley Mfg. Co., P. O. Box 192, Shillington, Pa., is producing a boring, turning and facing head which will bore and face work up to 13 in. in diameter, and turn the outside diameter of studs or bosses up to 4½ in. in diameter. The above classes of work may be handled on milling, boring and drilling machines where the work remains stationary.

The head is made of steel, being 4 in. in diameter by 2⅜ in. long. The sliding block is made of oil-hardening steel, and is 4 in. long, 1½ in. wide by 2½ in. deep and has four openings ¾ in. in diameter to receive the boring and turning tools. Three of these openings are arranged in the front end of the block, and each of the openings are bored the full depth of the block, that is, 2½ in. Tools are held rigidly by three socket-head screws. The center opening will run true with the shank when set flush with head and when the graduated screw reads zero. The fourth opening is at right angles to the other openings and runs the entire length of the block, that is, 4 in.

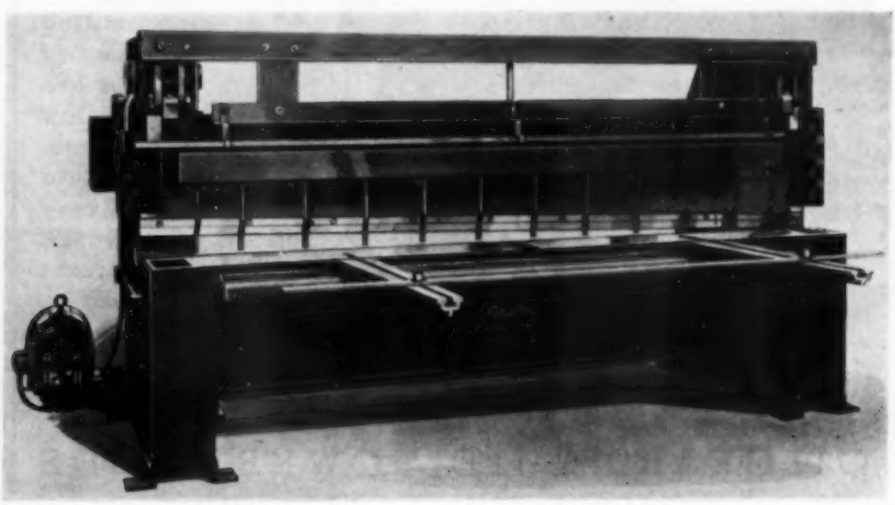
The bearing is of dove-tail construction and is fitted to the head without a gib. Tension screws are arranged so that all of the cutting strain is against the solid metal, regardless of the direction of travel. By adjusting these socket-head screws pressure is brought to bear against the brass angle pieces that keep the desired tension on the sliding block, or for locking the same in any location. The barrel is graduated in thousandths and has a star wheel on the outer end for adjusting while the head is revolving for such work as facing, undercutting, and back facing, or it may be adjusted by hand with a socket wrench placed in the broached opening in the end of the star wheel. The sliding block has 1 in. adjustment right or left hand from zero, for either power or hand feed.



Craley Boring, Turning and Facing Head shown with a boring tool holder in the longitudinal hole in the sliding tool block

Beatty All-Steel Totally Inclosed Plate Shear

The Beatty Machine & Mfg. Co., Hammond, Ind., has announced a plate shear of all-steel totally inclosed construction. No flywheel is employed in this machine. Control is effected by means of a pushbutton for either single-piece cutting or continuous operation. Vertical stresses are transmitted to the ram and are not carried by the throat, thus minimizing deflection. A clear view of the work is afforded. Large or small sheets may be sheared within full view of the operator at all times. An adjustable rear squaring gage is provided with a range of 2 in. from the blade to any specified width. The shear is built in a number of sizes.



• TRADE • PUBLICATIONS

CUTTING TOOLS. The Hutton Tool, Inc., 1128 Harper St., Detroit, Mich., has issued a mimeographed circular "Adaptations of Hutton Drives, New Cutting Tools." There are shown adaptations of the Hutton drives to interchangeable standard counterbores and counterbore holders, interchangeable core drills and core drill holders, spot facers, combination reamers and spot facers, multi-diameter cutting tools, form milling cutters and other tools.

GEAR CUTTING APPARATUS. The Fellows Gear Shaper Co., Springfield, Vt., has issued a series of publications as follows: "Hourglass Worm-Type Thread Generator," "The No. 8M Red Liner for Automatic Gear Inspection," "No. 7M Gear Measuring Machine, for Checking Individual Elements of Gear Teeth," "Original Fellows Gear Shaper Cutters, for Cutting External and Internal Spur Gears," "No. 4M Involute Measuring Machine, Including Circular Pitch and Cone Point Testing Fixtures," "No. 10LS Recess-Type Gear Lapping Machine," "6-Type Fellows Helical Gear Shapers." Each of these bulletins is completely illustrated and describes the principles of construction and the method of operation of the equipment involved.

FORGINGS. A four-page circular, issued by the Kropp Forge Co., 5301 W. Roosevelt Road, Chicago, Ill., discusses its facilities for making difficult forgings, and gives a partial list of the forgings that have been manufactured by the company.

PUMPS. Centrifugal pumps for acids and alkalies are covered in a new bulletin issued by The Duriron Co., Dayton, Ohio. Included in the general bulletin is a brief analyses of the different corrosion-resisting alloys in which the pumps are procurable. The bulletin is known an No. 172.

SAFE WELDING PRACTICES. A revised edition of "Precautions and Safe Practices" is being offered by The Linde Air Products Co., 30 East 42nd St., New York, N. Y. It will prove of interest to everyone responsible in the storage, care or handling of oxy-acetylene welding and cutting equipment.

SHEET IRON. The Republic Steel Corp., Central Alloy District, Massillon, Ohio, published the 5th edition of its booklet, "Sheet Iron—A Primer." The book contains 64 pages and tells of the manufacture of sheet iron from ore to final inspection of the completed sheet. It contains gage tables and a glossary of metallurgical terms.

STANDARDS. The American Society for Testing Materials, 260 South Broad St., Philadelphia, Pa., is distributing the 1934 edition of "Book of A.S.T.M. Tentative Standards." This book, which contains 1,250 pages, comprises 236 tentative standards, of which 48 are included for the first time. Some 60 tentative standards have been revised and appear in their latest approved form. Among new tentative specifications of interest are: Electric-fusion-welded steel pipe for high-temperature and high-pressure service; alloy steel castings for valves, flanges and fittings for service at temperatures from 750 to 1100 F., and for the same temperature range, seamless alloy-steel pipe; sheet-copper silicon alloy; copper-silicon alloy rods, bars and shapes, and plates and sheets; and magnesium-base alloy die castings.

• *At Right:* Natco multiple spindle drill, Oilgear Fluid Power Feed equipped.

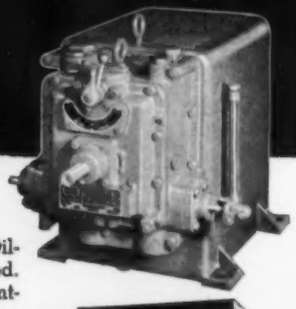
NEW FLUID POWER FEEDS

100 to 600% More
Rapid Traverse Speed

Up to 50% Lower Cost

Compensated
For Speed Variations Under Temperature and Working Conditions

Get Oilgear's Big New Book. Free, of Course



• *Above:* A new Oilgear Fluid Power Feed. Note: Flanged mounting, as integral machine part . . . Inside pump, eliminating hazard and bettering appearance . . . Self-contained; auxiliary valves, tubing, etc. are integral with pump . . . Many other exclusive features.

WITHOUT greatly altering existing machines, new speed and smoothness are achieved at new low cost by Oilgear's record-breaking new Fluid Power Feeds. Every builder, every buyer, should have the facts; get Oilgear's book. The OILGEAR Company, 1309 W. Bruce Street, Milwaukee, Wis.

OILGEAR FLUID POWER FEEDS

(B-1204)

American Machinist

December 19, 1934

When the Fleet Comes In

ROBERT J. WALKER
Lieutenant Commander,
United States Navy

How well equipped are the Navy Yards to handle the major and minor repairs that are always necessary?

THE CHRISTMAS Holidays are upon us and the fleet is coming home, home to the bases and Navy Yards on both our long coast lines. The strenuous months of gunnery, aviation, tactical and engineering exercises are over, and the long sought breathing spell has arrived. The lucky ones will get leave, the others will stay aboard to prepare for the traditional Christmas Week festivities of the Navy.

You all have your own ways of celebrating Christmas, but I question if they mean more to you than ours. We dress our ships and all hands prepare to play host to the thousands of visitors, a job the Navy always enjoys. Pine trees are hoisted to the tops and yard arms, the gangways festooned with greens, the quarters of both officers and men filled with bright trimmings. Each division of men tries to outdo the other division in making its quarters as attractive as possible, for a prize is awarded for the most artistic and appropriately decorated compartment. On Christmas Day every sailor plays Santa Claus to the poor children from miles around, at a dinner that is a dinner, with a toy at every place and another on the tree.

If you have never visited a Navy Yard you will be interested in seeing one at this time of year particularly. Bring the youngsters and enjoy the thrills they get both aboard ship and in the shops and yard. And then look critically at our facilities and form your own conclusion.

Suppose you live in or near Philadelphia. If you visit the yard there one of the first things you will see will be the huge 350-ton hammer head crane portrayed in Fig. 1. It almost breaks your neck as you look up at the top; you can imagine the sensation from that elevation if they would let you up there. Back in the shops you may be fortunate enough to see a big propeller under construction. This yard is proud of its propeller work. Among those that have been made here is the one for the Leviathan which is shown being machined in Fig. 2. The balancing process is illustrated in Fig. 3. It is essential in order to avoid propeller vibration that would affect the accuracy of the many delicate instruments aboard ship. Without balancing it would be impossible for gun pointers to keep their cross wires on the target, and would prevent those who go to sea from catching up on their sleep.

Fig. 1—The hammerhead crane that dominates the landscape in any Navy Yard. This one is in the Philadelphia Yard

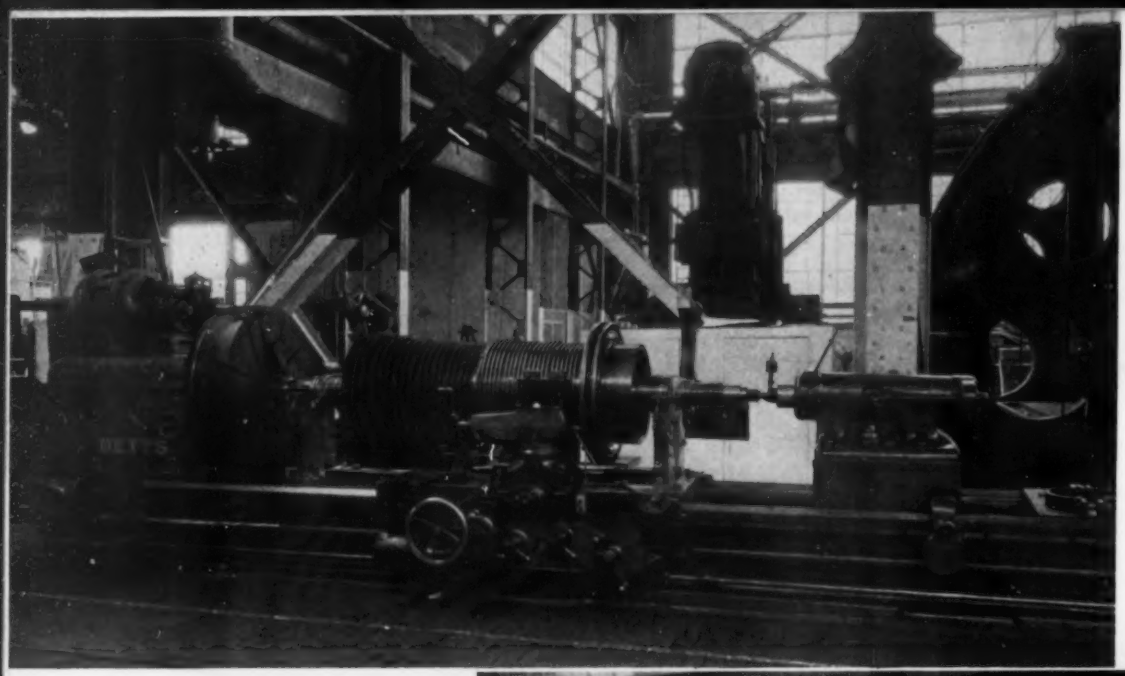


Fig. 5—The big engine lathe is the basic tool used for machining the rotors for the main turbines of battleships and cruisers

Fig. 6—When the engine lathes lose their original accuracy and are superseded by better designs they are relegated to such jobs as rough shaft turning

Armor plates, heavy and tough, present real machining problems. Fig. 4 shows experimental cutting of a massive piece with a saw the teeth of which are tipped with tungsten carbide.

Turbine rotors have to be carefully and accurately machined in large lathes, Fig. 5. When these lathes get old they must be retired to turning shafting and doing other work where exacting tolerances are not demanded, Fig. 6.

Multiple drilling of boiler drums is difficult if you haven't the right equipment. The Norfolk Navy Yard is not in that predicament, however. Its modern drilling machine for this work is shown in Fig. 7. At Norfolk also is one of the best equipped heat-treating departments in any Navy Yard. Some of the electrically controlled furnaces are illustrated in Fig. 8. Other yards are hopefully awaiting funds to bring their heat-treating equipment to a comparable standard in order to secure maximum strength of materials treated, and reduce rejections to a minimum.

The machine tools in the various Navy Yards, with the exception of the Naval Gun Factory at Washington, D. C., are primarily for work under the cognizance of the Bureau of Construction & Repair and the Bureau of Engineering. Because more than one bureau is interested in this equipment, the Assistant Secretary of the Navy has been made responsible, and it is through his office that all recommendations for new equipment and replacement of old equipment must pass.

Equipment such as lathes, milling machines, boring mills, etc., is carried on capital account and not chargeable to indeterminate or overhead account. Therefore, it is necessary for Congress to make direct appropriation for the purchase of Navy Yard needs.

After the war the activities of the various Yards were greatly curtailed and as a result much surplus machine tool equipment lay idle. This surplus was drawn on from time to time as the machines in operation began to break down or wear out. In fact, up until 1930 no new equipment of any considerable amount was purchased.

By 1929 the Assistant Secretary of the Navy's Office realized that appropriate steps had to be taken to keep down the mounting labor costs of operating old and obsolete tools. Further, the art of working metals had advanced to such a stage that new and additional equipment was found to be an economic necessity.

Early in 1930 an inspection of the Continental Navy Yards was ordered by the Navy Department. The inspection party consisted of—Mr. Barton P. Phelps, Mechanical Engineer (Shop Su-

perintendent of the Atchison, Topeka & Santa Fe Railroad); Lieut. Commander Robert J. Walker, U.S.N. (Officer in charge of machine tools and manufacturing section and representative of the Bureau of Enginering); Lieutenant L. T. Haugen (CC) U.S.N. (Assistant to Officer in charge and representative of the Bureau of Construction and Repair); Mr. E. G. Herndon, Senior Mechanical Engineer, Navy Yard Division (Machine Tools); Mr. F. C. Nichols, Materials Engineer, Navy Yard Division (Portable and Hand Tools).

At this point it is well to state that the Atchison, Topeka & Santa Fe Railroad deserves a great deal of credit for the loan of the services of Barton P. Phelps, an exceptionally capable engineer whose criticisms and suggestions throughout were most helpful.

From orders and conferences held prior to the inspection trip it was understood that the Department desired to accomplish the following with respect to machine tool equipment:

I—Maintain machine tools in all Yards to a standard that would insure—

(a) Sufficient number of each type of tool to handle work load required or in prospect.

(b) Accurate machining.

(c) Economy in production.

(d) Safety in operation.

II—Maintain shop buildings, yards and appurtenances which would give—

(a) Proper housing to preserve the required tools.

(b) Housing facilities which would favor economical production of work by location of buildings with reference to the work and the proper arrangement of the tools in the buildings.

(c) Safety of personnel working in these buildings.

Basing on these instructions, inspection was made of tools, yards and equipment in as much detail as time permitted, special attention being given to machine tools. Typical conditions of the various shops in all yards are shown in the photographs on the immediately following pages. Among the tools inspected were many that were really museum pieces. Probably one of the oldest of the old faithfuls was a planer purchased in 1869 and still in use in the Navy Yard at Portsmouth, N. H., Fig. 11. Norfolk still has a similar one in use. How fine it would be to be able to replace these machines with new ones capable of turning out work many times faster and of required accuracy.

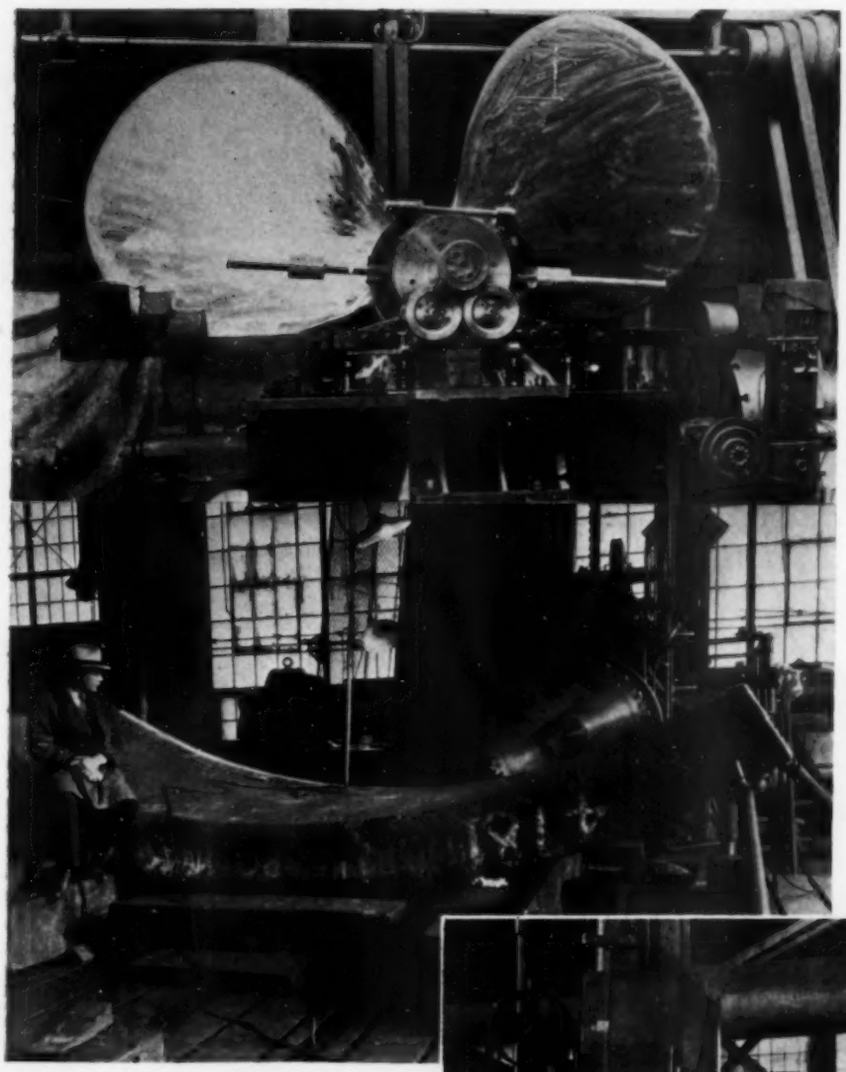


Fig. 3—An important part of propeller finishing is the balancing operation to check the work being done in Fig. 2. Fig. 4—Armor plate is about as mean stuff to machine as you can find. Here is an experimental job using a saw with teeth tipped with tungsten carbide

Fig. 2—Navy Yard shops have the facilities for machining ship propellers. They take care of work for merchant ships as well as for their own craft, as is shown by the presence of this Leviathan screw in the Philadelphia Yard shop

New construction calls for the scarfing and flanging of many large deck plates. New planers can cut with from seven to eight tools at one time while these old timers must struggle along with only one or possibly two. The Futtock saw of Fig. 12 originally installed in 1873 was shipped down to Boston to help rebuild the Old Constitution.

The paint shop at Norfolk is gradually being re-equipped. The big pebble mill, Fig. 9, has relieved the load on the small mills seen in Fig. 10 which required much unnecessary help.

An old vertical boring mill on which several thousands of dollars have been spent in its lifetime, mostly in an effort to repair the existing clutch or apply a better one, appears in Fig. 13. Several mechanical brakes have also been constructed, but the wedge shown here has been found to be the most reliable in preventing accidents.

The old vertical rolls of Fig. 14 were once operated by steam but have been modernized (?) to work with air. How helpful and how much more economical it would be to replace the woodworking equipment shown in Fig. 15, so as to do away with the costly belting and speed up the work being turned out.

Unfortunately arc welding sets do not have a long life. Those in Fig. 16 are ready for the scrap pile but they still have to be pressed into service on account of the present building program. Although the old alligator shears in Fig. 17 may use too much current and the operator will have to stand well back when cutting, additional funds must be provided before this piece of equipment can be retired.

An effort is being made to do away with all overhead belting. Not only is overhead belting hazardous but it cuts down on the efficient lighting of shops and is costly to maintain. Every shop master lives in hopes that conditions such as those in Figs. 18, 19, 20 and 21 may soon be remedied. Present policy dictates buying all new equipment with individual motor drive so that when the machine is not in operation no current is required for moving unnecessary belting and shafting.

Contrast the shop conditions just illustrated with those in shops having more modern equipment, equipment where the proper speed for cutting can be almost instantly obtained without loss of time or risk to life or limb as shown in Figs. 22, 23 and 25. How different the modern direct motor driven milling machine looks in Fig. 24 against its predecessors in the background; how much more sturdy, more accurate and more versatile in operation.

The machine tool industry is continually striving to improve its products. Closer tolerances, safety and greater ease and speed of operation are demanded by the users of such equipment. Machines that are belt driven are not the only ones that are becoming obsolete. Manufacturers realize that it is profitable to replace equipment which can no longer take heavy or fast cuts. Compare Fig. 26 with Fig. 27 where the time of doing the same piece of work is less than one-third, and Fig. 28 with Fig. 29 where the time of drilling the same number of holes (of which there are thousands) is only one-fourth. The drilling machine in Fig. 30 doubles the production and halves the cost of that shown in Fig. 31. In Figs. 32 and 33 are two machines required to do the same type of work, the latter seventy-five per cent more efficient, not hazardous and comparatively free from blade

NAVY YARD EQUIPMENT ESTIMATES FOR 1931. March 1, 1930.

(a) Name: 1 Lathe, engine Yard Mare Island Prior. No. 66
Motor Driven.

(b) Size: 20" x 8', selective head. 65

(c) Estimated Cost $ 3373
*(d) Installation Cost $ 58
Total $ 3431

(e) Approx. hrs. used per yr. 1500 Est. save per yr. $

*(f) Reason for installation- Avoidance of shift work.

Replaces 1257

(g) No. of each to replace : Additional equipment. Age 35 Yrs.

(h) Shop in which to be installed: Shop 431, Bldg. 271, 2nd Gallery.

Remarks. Should be high speed equipment suitable for use with Carboloy. Additional lathe would assist in machine tool balance and help to avoid shift work.

Fig. 42—The record card at the upper left was used by a Navy inspection party in recording the age and condition of equipment studied in the various Navy Yards

Fig. 9—Below is a view of the big pebble mill which has been installed in the paint shop at Norfolk to increase efficiency

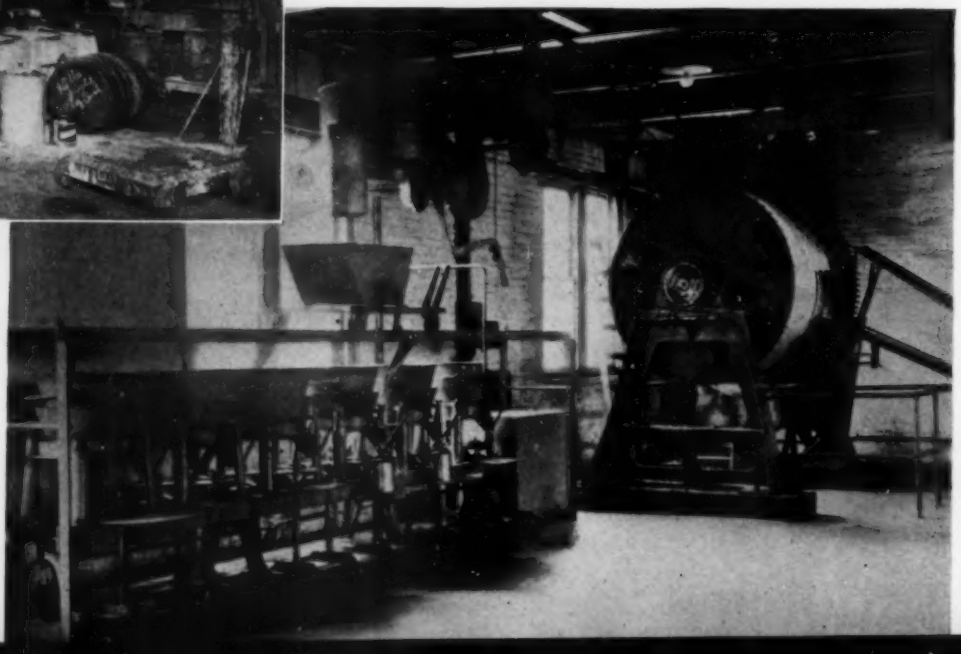


Fig. 10—The men above with their inadequate equipment formerly were needed for the job now done by the pebble mill of Fig. 9. Waste was considerable

breakage. A milling machine of the age shown in Fig. 34 can only remove about 5 cu.in. of cast iron per min., while that shown in Fig. 35 can remove 15 cu.in. of the same metal in the same time. Two power brakes are shown in Figs. 36 and 37. The simplicity and strength of the modern unit as compared with the ancient one are evident.

The plating shop has also made improvements in its methods of plating small pieces. The Navy Yard at Bremerton, Washington, is at present awaiting funds to buy another barrel plater like that in Fig. 38 which would pay for itself in six months by doing away with the needless operations shown in Fig. 39.

In our tool rooms rotary cribs like that shown in Fig. 40 are slowly finding their way in, in order to insure more prompt delivery of cutters, drills, taps, etc., as well as to allow for their more perfect stowage in an already too crowded space. Congestion in the shop shown in Fig. 41 makes it impossible to arrange a better pipe storage rack even though the existing one stalls traffic as illustrated.

In order that full information as to each yard's needs might be easily and completely presented to the inspecting party mentioned above, the Commandant of each Continental Yard was requested to have the form on page 864 filled out on cards for each piece of equipment desired or considered neces-

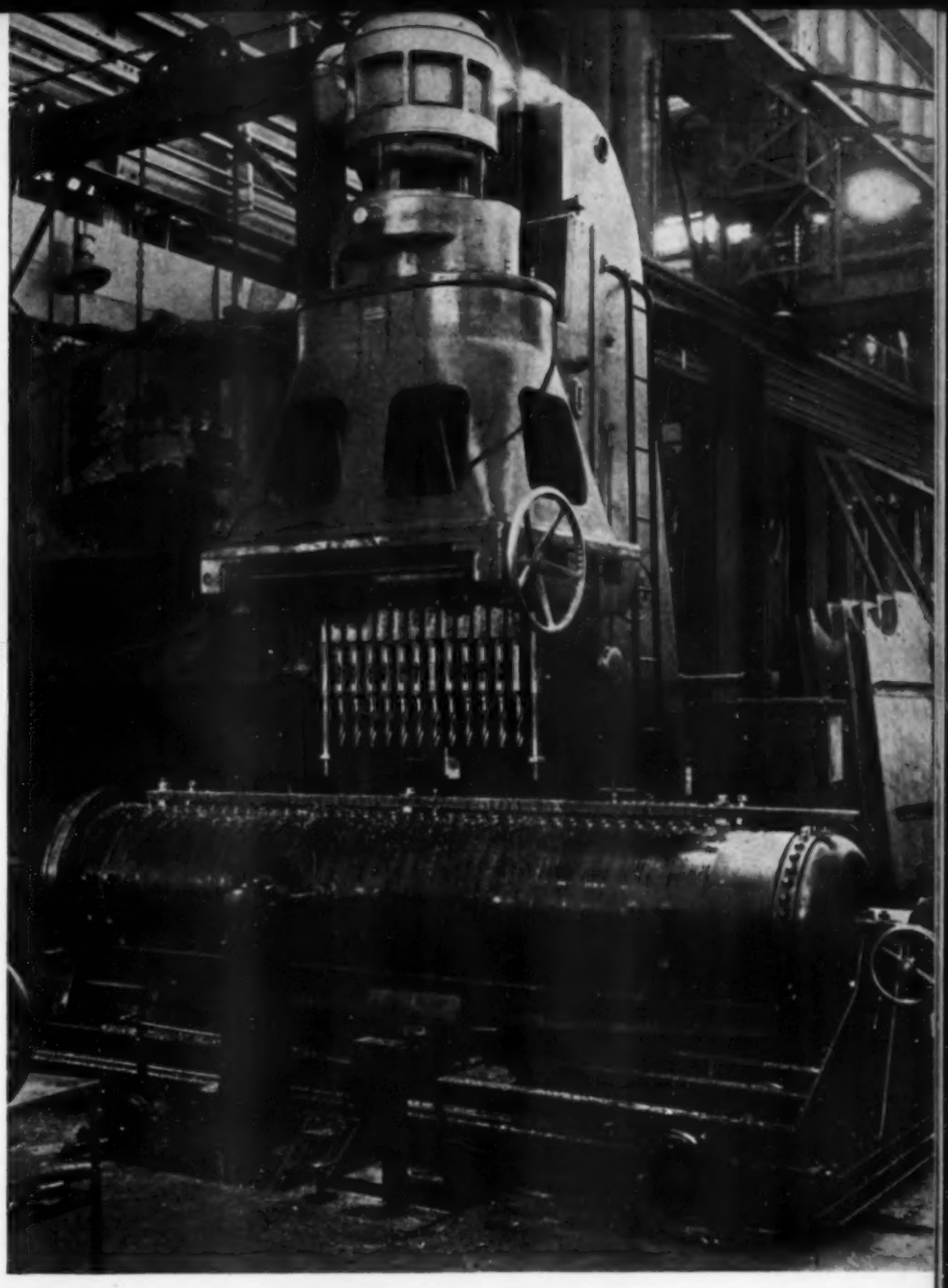


Fig. 7—Modern multiple drilling equipment is essential for such jobs as the boiler illustrated here. This machine is in the Norfolk Navy Yard

Fig. 8—Up-to-date heat-treating facilities are a vital part of the equipment of any Navy Yard. Norfolk is fortunate in this respect

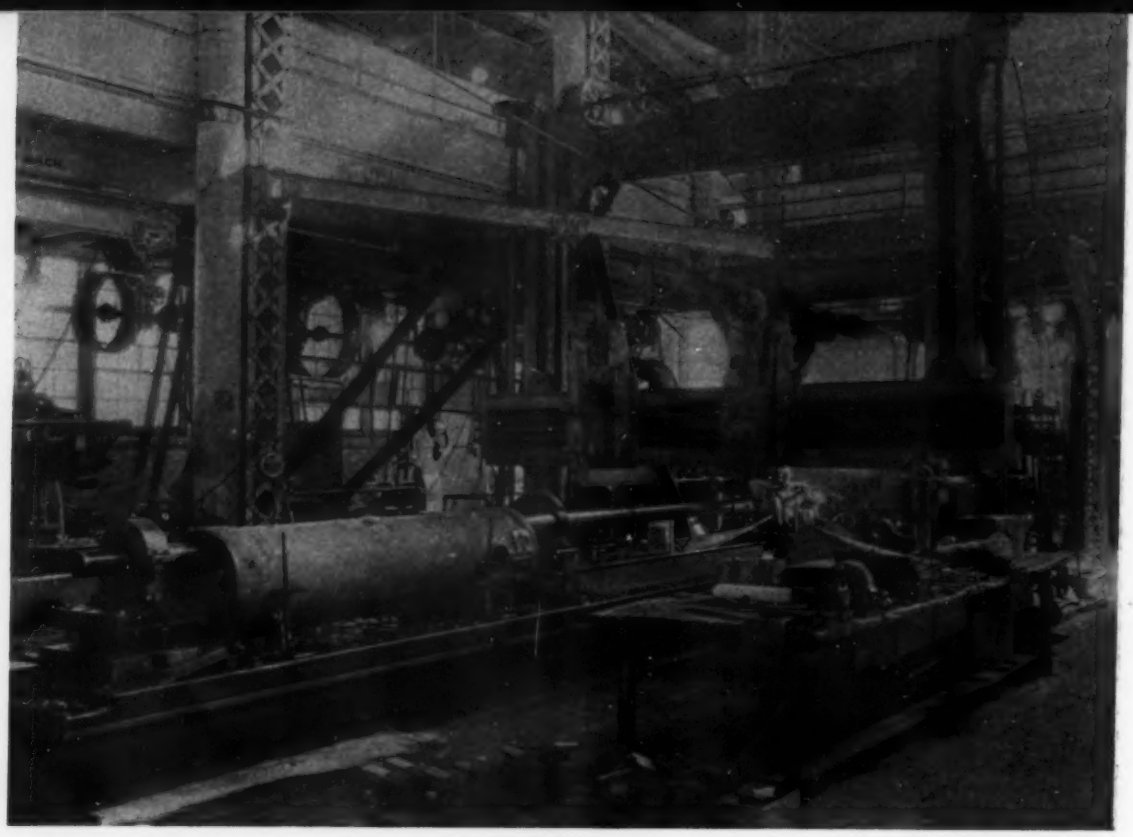


Fig. 11—A patriarch of planers. This big one has been in place at the Portsmouth Navy Yard since 1869. It surely deserves a rest

Fig. 15—Hopelessly obsolete, the woodworking machine shown above should be replaced. Fig. 16—Arc welding sets become obsolete as the art advances. Those at the right should be disposed of

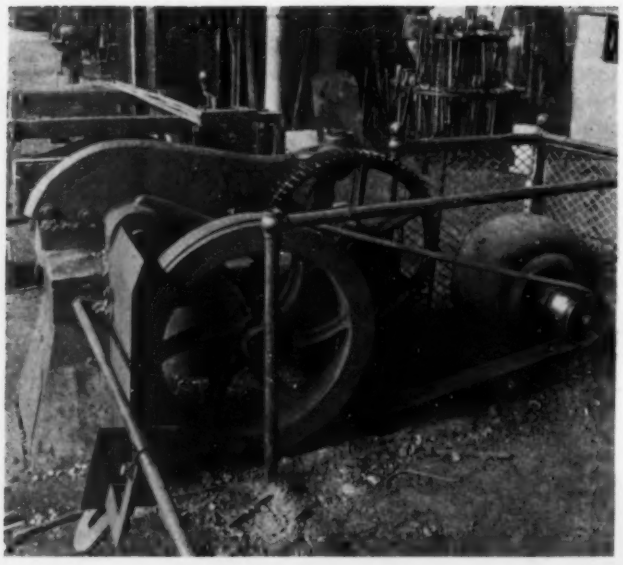


Fig. 17—In addition to being inefficient these old shears above are dangerous. The operator has to stand back to avoid flying pieces

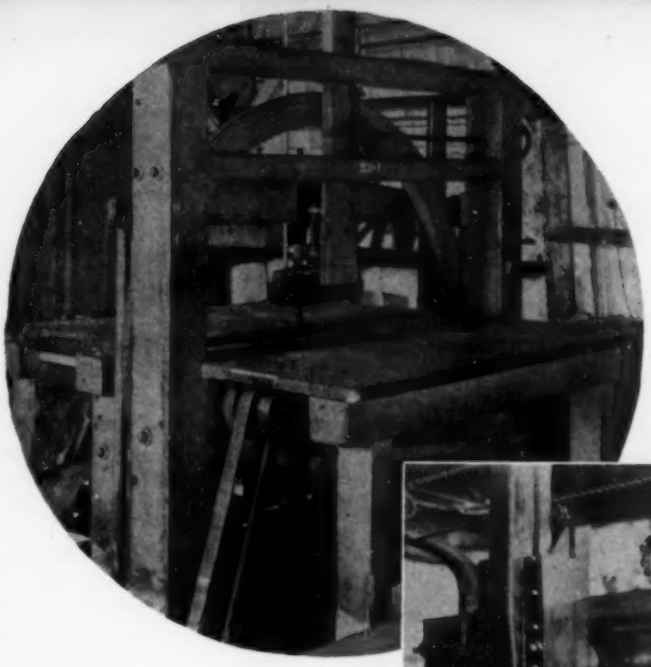


Fig. 12—The futtock saw at the left was resurrected from the Portsmouth Yard and sent down to Boston to aid in rebuilding the Constitution

Fig. 13—Thousands of dollars have been spent on this old boring mill at Bremerton in an endeavor to get a satisfactory clutch. The only sure way to stop it is the one illustrated

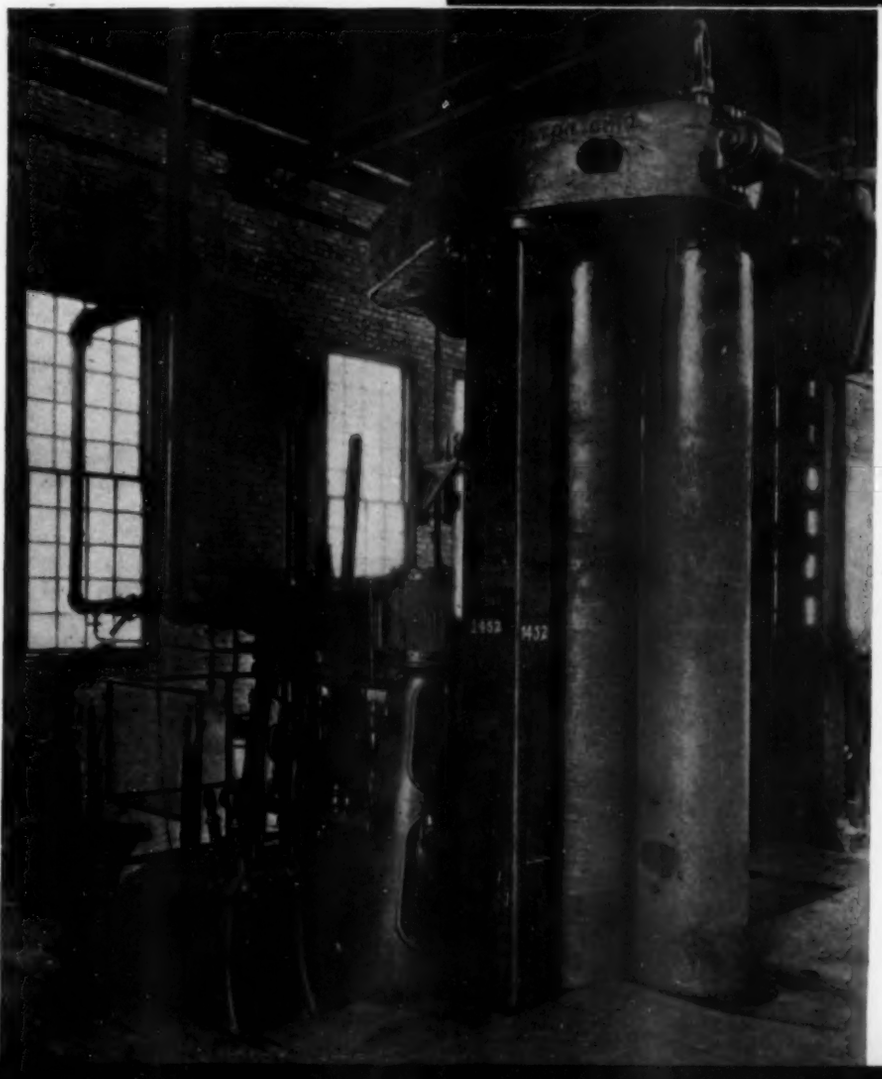


Fig. 14 — Originally driven by a vertical marine steam engine the ancient rolls shown here have been modernized (?) by converting the engine to the use of air. Modernization of this sort can seldom be set down as either efficient or successful

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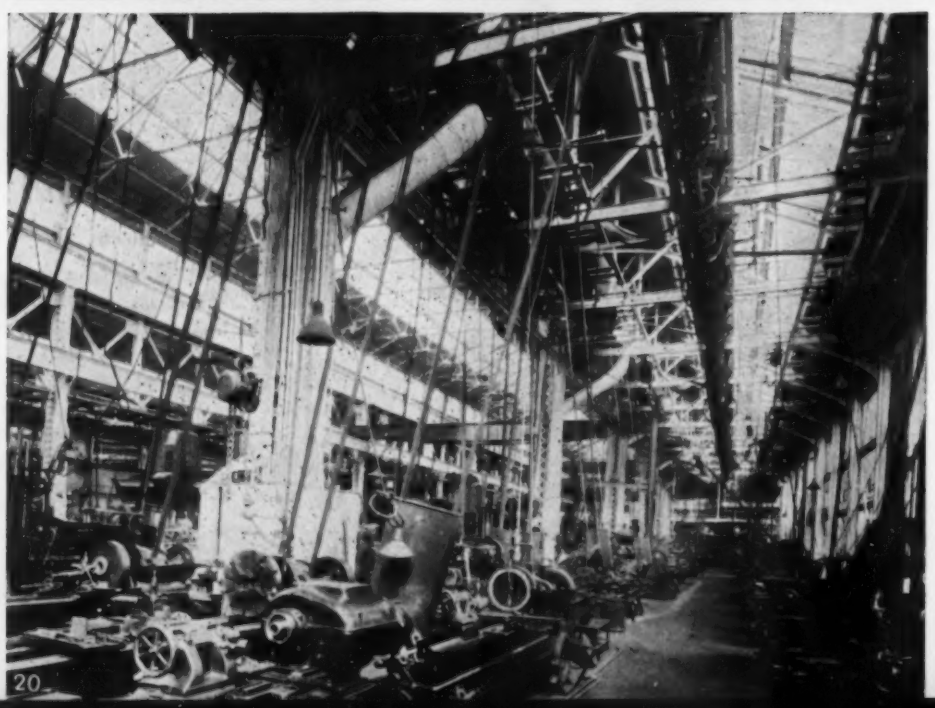
19



20

Figs. 18, 19 and 20 — These three views show conditions in various shops that are strongly reminiscent of the ways of a past generation. Navy shop masters who have to contend with the handicaps of out-of-date machines and inefficiently applied belt drives are hopeful that funds will be forthcoming with which to clean out the obsolete stuff and reduce their costs by installing modern equipment. To meet the requirements of the kind of work done in Navy Yard shops those in charge have adopted as a standard policy the use of motor driven machines with their inherent flexibility and versatility

Fig. 21 — Another example of the days of our fathers, or even grandfathers, is this woodworking shop. Note the unusual height of the shop ceiling and the consequent length of the driving belts. Such a layout would not be tolerated in a plant that had to make a profit or pass out of the picture

▼

sary. See Fig. 42. These cards proved to be most helpful. They were carried along with the inspecting party and appropriate notes made on them as each tool up for replacement was visited. The cards which called for new equipment other than replacement tools were discussed at the proposed points for the new installation. By this method it was fairly simple to make a definite decision right on the spot as to the relative need for a new machine and whether or not the type and size requested was proper.

After visiting all of the shops in each yard the cards were arranged by mutual agreement between the Yard officials and visiting officials into a common priority list.

These lists, along with lists submitted by the Navy Yards not on the continent, were worked into a single priority list by the board, the most important equipment needed being on top and the least important at the end.

Before making the inspection early in 1930, it was considered desirable to determine the probable annual replacement cost of machine tools and the relation of this sum to the value of the equipment in the Navy Yards as a whole. Reference was made to the 1929 Annual Report of the Paymaster General of the Navy. From this report it was noted that the initial cost of all machine tools in the active Navy Yards under the direction of the Assistant Secretary of the Navy's Office totaled $28,244,563, and the appraised value totaled only $4,965,018. For accounting

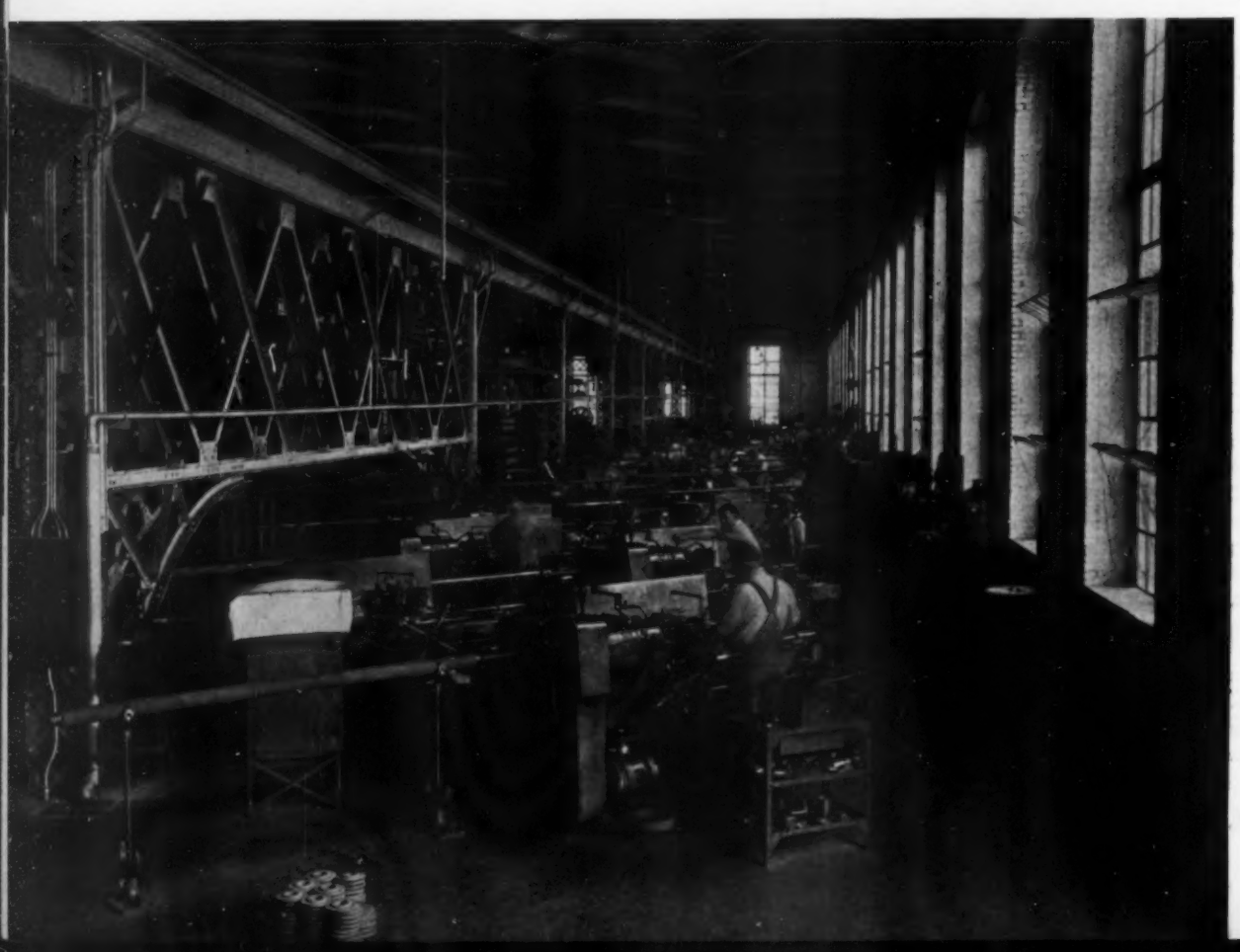
Fig. 22—By no means all of the equipment in Navy Yard shops is of the obsolete type, as is evidenced by this view of a battery of modern engine lathes in the Philadelphia Yard. With the exception of the lathe in the foreground, which dates from 1919, none of the machines shown is more than five years old

purposes the value of machine tools is depreciated at the rate of 5 per cent per year.

From correspondence in the files with respect to replacement values of machine tools in 1929, the following figures were set down showing the initial cost of machines in each yard and the calculated replacement value.

	Replacement Value	First Cost
Portsmouth	$2,310,000	$1,822,700
Boston	4,120,000	3,252,086
New York	6,324,000	5,015,439
Philadelphia	5,464,000	4,328,164
Norfolk	6,050,000	4,757,700
Charleston	1,465,000	1,163,269
Mare Island	4,010,000	3,170,839
Puget Sound	3,410,000	2,703,776
Pearl Harbor	1,670,000	1,322,426
Cavite	894,000	708,164
Total	$35,717,000	$28,244,563

Fig. 23—Out at the Mare Island Navy Yard in California they are well satisfied with this group of modern turret lathes, individually motor driven and well lighted



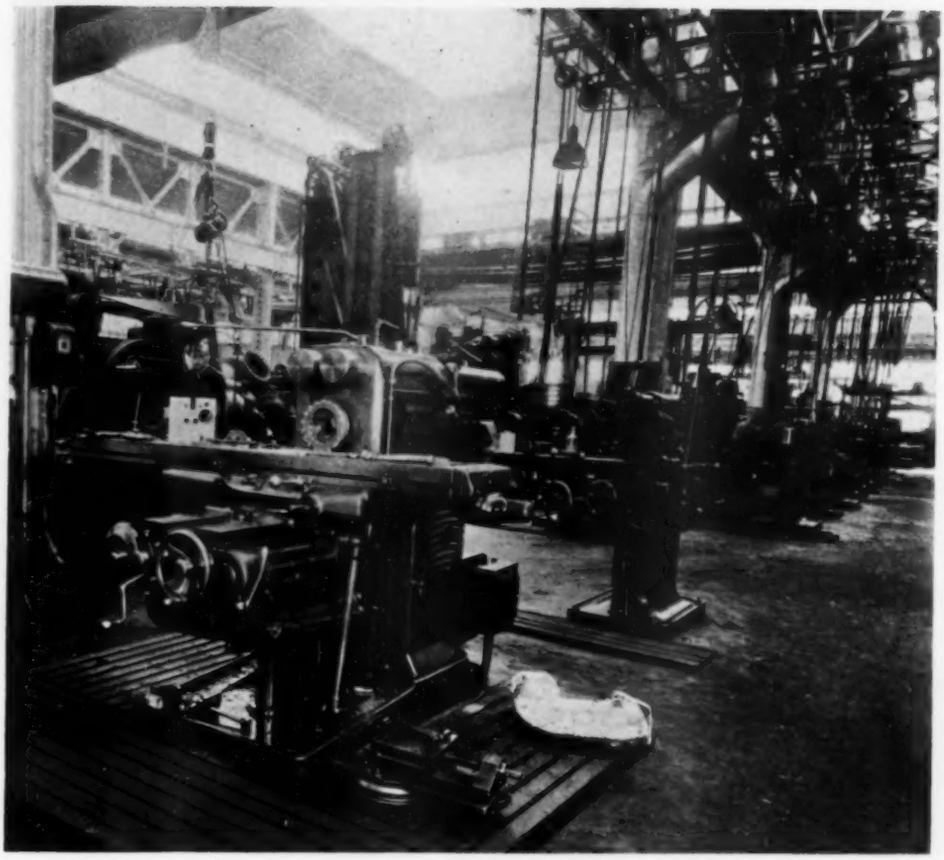


Fig. 24—A single modern milling machine with built-in motor drive stands out in striking contrast to its respected ancestors in the background of this illustration. This tool is less than two years old. It may be more charitable to say nothing about the age of the other ones

The average replacement value above was approximately 1.264 times the initial cost, perhaps a little low for some yards but on the whole on the conservative side.

Assuming all tools replaced when 20 years old at 1929 prices, then the annual replacement cost would be

$$\frac{\$35,717,000}{20} = \$1,785,850.$$

Or, assuming all tools replaced when 25 years old at 1929 prices, the annual replacement would cost

$$\frac{\$35,717,000}{25} = \$1,428,680.$$

Installation costs roughly average 10 per cent of the cost of the equipment. The above replacement does not include portable power tools or loose and hand

Fig. 25—The Philadelphia Navy Yard has a well arranged turret lathe department in Building No. 16. This layout compares favorably with many an industrial plant

tools which when replaced are chargeable to overhead.

The Department's records showed that $1,600,000 worth of surplus machine tool equipment had been used since the war; that the supply of such equipment had been exhausted and that during the years 1925-1929 inclusive only an average of $260,000 per year had been spent on new machine tools.

The board after completing its visit to the yards in May, 1930 and bearing at all times the following points in mind, namely—

(a) Reduction of load at certain yards;

(b) Increase of load at other yards;

(c) Investments which should be made in machine tools and other equipment for reducing labor costs and increasing efficiency which were requested

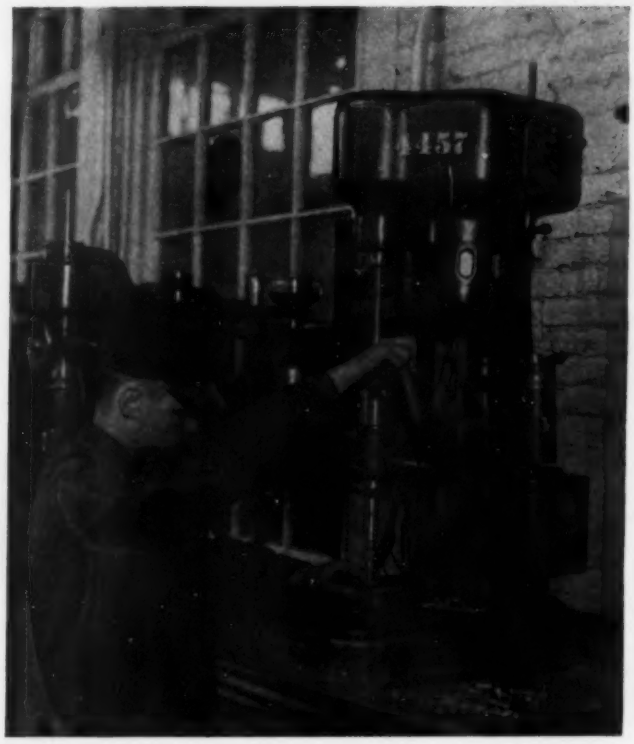
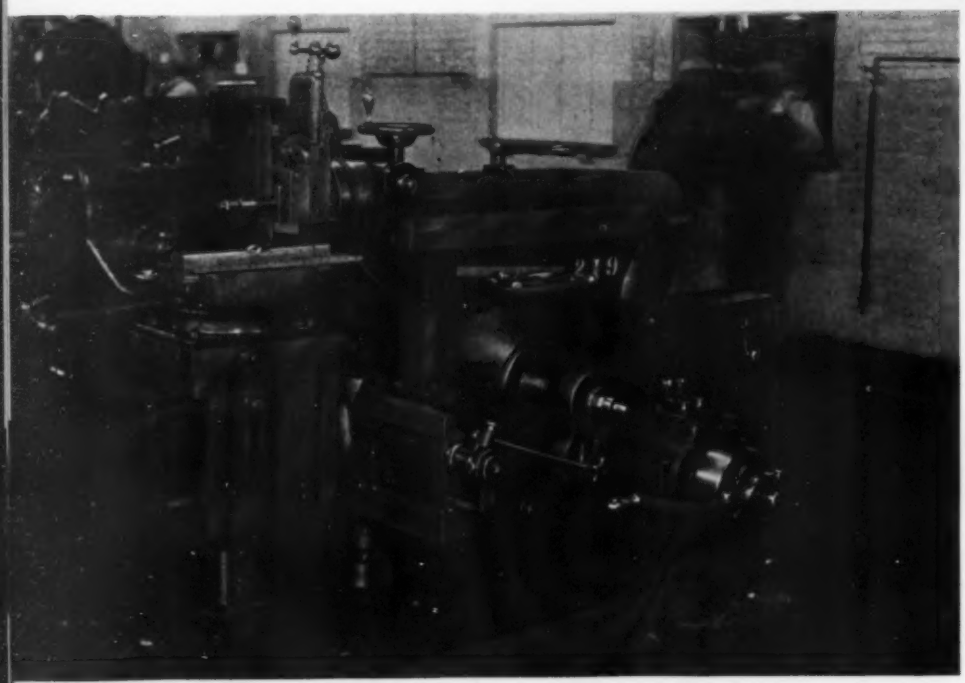


Fig. 30—Some idea of what can be done with modern machine tools may be had by comparing this drill with the one opposite. Production is doubled and cost is halved



in addition to the tools required for replacement;

(d) Check of value and age of existing tools;

(e) Inspection of shops;

(f) Observation of work on hand;

(g) Estimate of work in prospect;

decided to recommend to the Department that $1,500,000 should be spent annually for at least five years (fiscal years 1930, 1931, 1932, 1933 and 1934) for replacement of machine tools, with the further recommendation that at or before the expiration of this five-year period the yards should again be surveyed with respect to equipment and work on hand or in prospect and the replacement program revised accordingly.

Fortunately the recommendation as outlined, after a careful hearing in May, 1930 before the Congressional Commit-

Figs. 26 and 27—Shown at the left are old and new machines of the same type but quite different in performance and efficiency. The new one, below, does the work in one-third the time taken by the old one

Fig. 31—This old drill was good in its day but that day passed into history many years ago. It is hopelessly outclassed by its younger brother opposite

pended while the year 1934, which had only $500,000 for machine tools, received almost its recommended allowance from P.W.A. funds.

At present the Navy Yards have a work load greater than at any time since their war time peak. With the present building activity, where arc welding has replaced riveting, where stainless steels harder to cast, tougher, and harder to work have replaced ordinary steels, and higher speed machinery with its demands for closer and closer tolerances is being specified, the government yards are more in need of new machine tools and equipment than at any period since 1917.

A recent resurvey of the yards confirms the need for continuing a yearly expenditure of $1,500,000. In fact, insufficient funds in 1932, 1933 and this

tee on Naval Appropriations, was favorably received and as a result the Naval Appropriation bills for the fiscal years ending June 30, 1930, 1931 and 1932 carried the sum of $1,500,000 each year, exclusively for the procurement and installation of new machinery and equipment for shops under the cognizance of the Bureau of Construction and Repair and the Bureau of Engineering.

On account of the depression and the need for rigid economy, this sum of $1,500,000 was reduced to $500,000 for 1933 and 1934 and omitted for 1935.

The actual sums spent for machine tools during the past five years were:

1930	1931	1932	1933	1934
$1,500,000	$1,500,000	$900,000	$200,000	$1,451,220

In other words the sums appropriated for 1932 and 1933 were not fully ex-

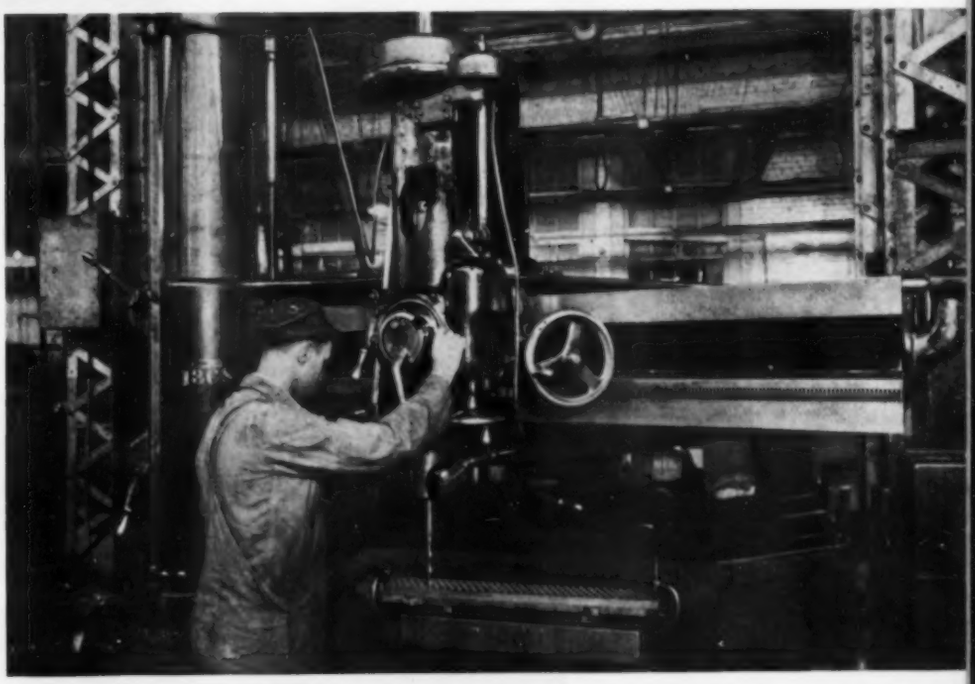
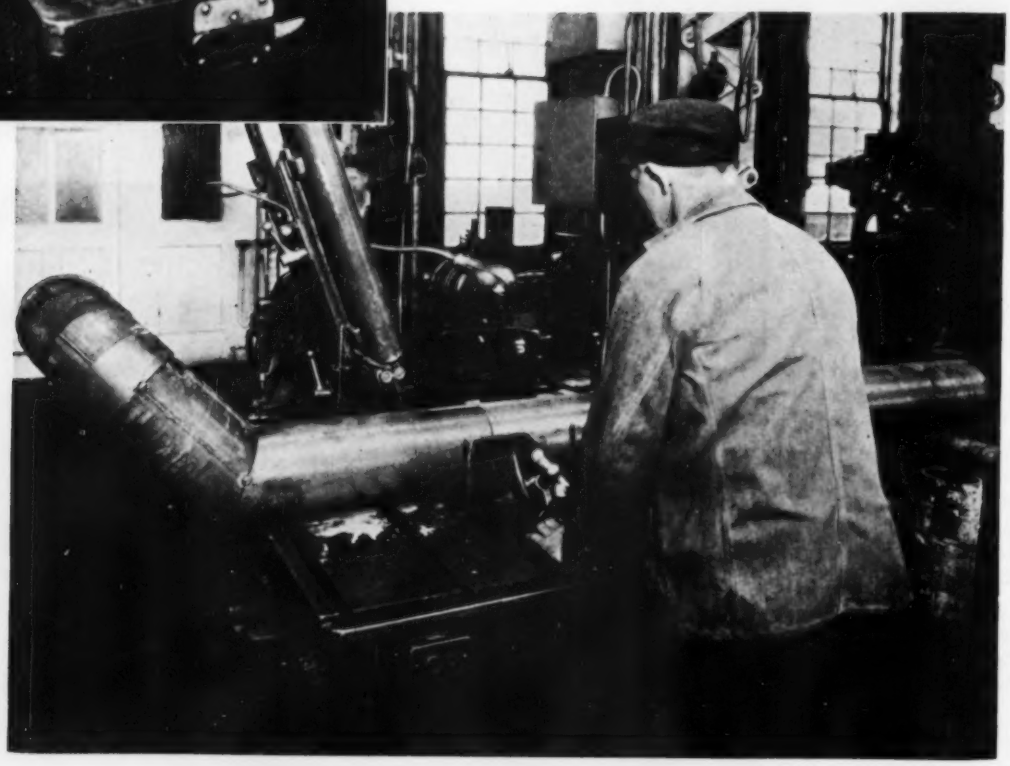


Fig. 28 and 29—Old radial drills do certain jobs fairly well, but when it comes to pieces in which thousands of holes must be drilled they lose out. The time taken by the modern radial is only one-fourth of that taken by the other

Figs. 32 and 33—Although not one of the major tools in the shop, the metal saw nevertheless is an important unit. The one shown below is some 75 per cent more efficient than its ancient prototype above. Moreover, it is far less hazardous and suffers less from blade breakage



fiscal year have caused the present priority list for new equipment to mount up to over five million dollars. If such a sum should be spent on replacement the average age of the tools upon retirement would be twenty-five years.

There is one situation which continually confronts those responsible for the proper functioning of the Naval repair facilities in time of a national emergency. Good, accurate machine tools require time to season their parts before machining, time for careful machining, scraping and fitting of parts together, and time for proper inspection of each

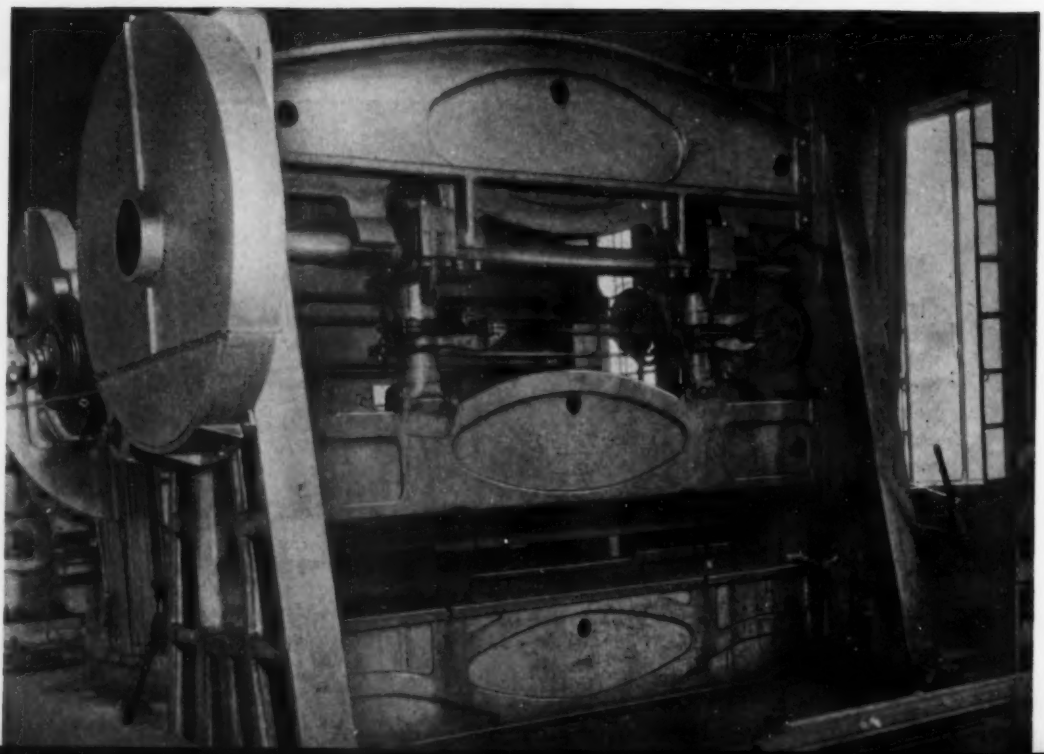


Fig. 36—This old power brake is slow and not very powerful. Furthermore, it has housings at both ends of the bed and is thereby limited in capacity. It is overdue for replacement

piece before and after assembly. Cutting of any of these times short results in an inferior product, a product that ultimately will not produce accurate, fine work which is demanded by the fighting machines of today. The more modern our Navy Yards are kept the lower their production costs and the fewer the number of machines that will be required from a market which undoubtedly would be greatly overtaxed by various demands in time of war.

It is understood that the machine tool industry is struggling under a very low rate of production. Whether or not P.W.A. funds will be made available to relieve this situation, or whether or not Congress will appropriate sufficient monies this coming session for greatly needed normal machine tool replacements at the Navy Yards, remains to be seen.

Fig. 34 and 35—One of the functions of a milling machine is to remove metal as rapidly as possible. The old one shown in the center can take off 5 cu. in. of cast iron per min. Its successor, above, is capable of removing 15 cu. in. of the same material in the same time

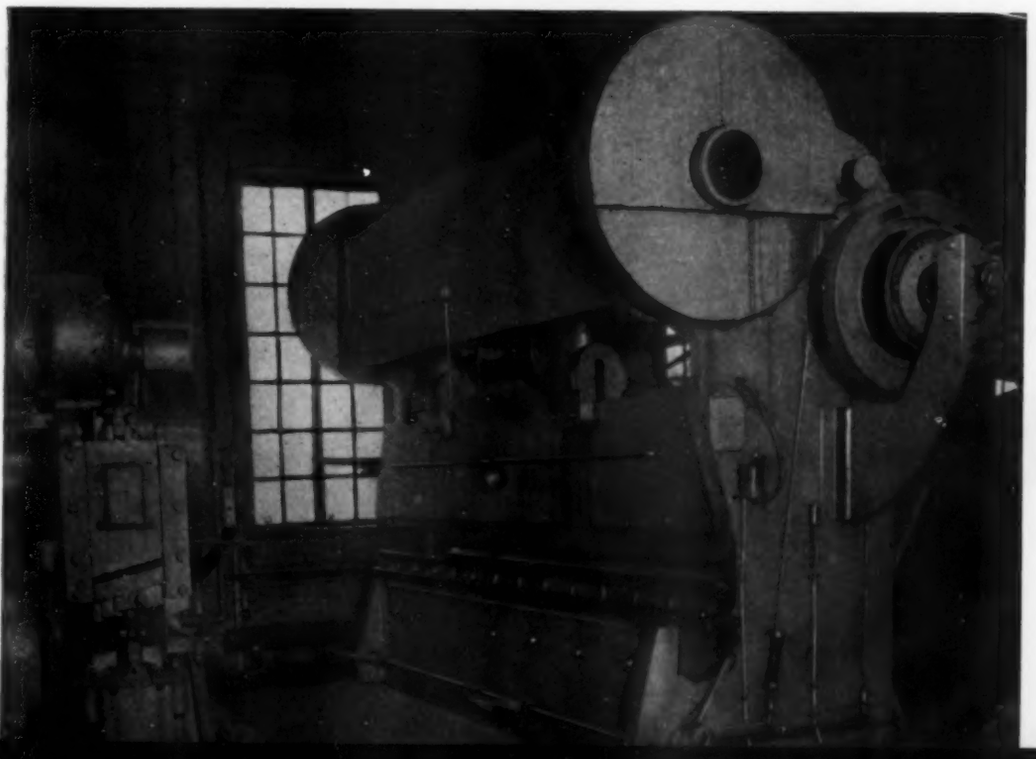


Fig. 37—The modern welded steel brake illustrated here is a sharp contrast to the old one opposite. It is distinguished by power and rigidity and it has the additional capacity possible in an open end unit

Fig. 40—This is what the Navy would like to use in its toolcribs if it had the money to buy ones like it. It saves time and loss in handling cutters, drills, taps, etc.

Fig. 39—The old system of stringing parts on wires preparatory to plating will be superseded by the barrel method when funds are in hand

Fig. 38—At the Bremerton Navy Yard the barrel plater shown paid for itself in three months. If funds were available others would be purchased promptly

Fig. 41 — At the Bremerton Navy Yard the pipe storage rack shown is made necessary by lack of space in the shop. It serves as an excellent blockade to shop traffic. Funds for a building addition are sorely needed

EDITORIALS

VOLUME 78 AMERICAN MACHINIST ESTABLISHED 1877 McGRAW-HILL PUBLISHING COMPANY, INC. NUMBER 26

K. H. CONDIT F. H. COLVIN
EDITORS

NAVY YARD NEEDS

TO THE LAYMAN the Navy means only ships and sailors, but to the men of the Navy and to those of us who understand machinery it means much more. When the fleet comes in it is in need of repairs, some major, some minor, depending on how long a ship has been at sea and what has been required of it since its last visit to a Navy Yard. We landlubbers have our automobiles and electric power plants and diesel driven streamlined trains, and we think of them as complicated machines, but they are elementary in their simplicity as compared with the intricacies of a modern cruiser or battleship.

● If we could accept Commander Walker's invitation and visit a Navy Yard this Christmas while the fleet is in, we should discover for ourselves how much machinery is crowded into the hull of a ship, and how vital it is to have adequate facilities for repair. And if we went on through the machine shops of the Yard we who know something about machinery and shop equipment would be appalled at some of the ancient machine tools with which the Navy shop men have to contend.

● Some of the illustrations showing conditions in Navy Yard shops and the type of equipment in those shops are illuminating, but also disturbing. There are times, of course, when speed is not essential and it may hurt nothing but Uncle Sam's pocketbook to let an 1869 planer wheeze its way slowly through a job that could be done in a fraction of the time, and at a fraction of the cost, on a modern machine tool. But there may be times when it is vitally necessary to get a ship back into service, and then is when the penurious policy of postponing replacement and modernization of machine equipment will exact a heavy toll.

● Commander Walker proposes a continuation of the five-year purchasing plan begun in 1930. According to this plan the needs of the Navy Yards are carefully studied by experts and the indicated purchases are spread over a period of five years, an equal amount being spent each year. This plan has been used successfully in private industry, but it should be even more satisfactory in such an establishment as the Navy where there is no pressure for profits, and where the exigencies of depression are not so serious. It is economically sound, and could be made to serve as a potent aid to employment in the heavy industries where aid is needed most.

● Look upon such a plan as an insurance policy, if you like. Insurance premiums must be paid regularly, and the amount varies little. We can't let them drop while we spend our money for something more attractive at the moment, and neither can we omit payments on our naval repair shop equipment if we are to have it available when we need it most.

● The Navy needs men, it needs ships, and it needs modern machine shop equipment. The machinery industry needs orders, its employees need work, and the community needs ways of moving men from relief to employment at their regular trades. Why not bring these needs all together and dispose of them at once? The sum of money required is not large and its expenditure would be highly effective.

Merry Christmas

IN THIS last issue of 1934 the editors of *American Machinist* extend to their readers heartfelt good wishes for a cheery holiday season. Perhaps the best Christmas present any of us could wish would be increased activity in our respective branches of the industry, because such an increase spells relief from the hard times that have beset most of us. Some of us are going to enjoy that kind of a Christmas present because some branches of the industry are already sharply active. May the rest of us profit likewise before many weeks.

Industrial Cooperation

GREAT CREDIT is due the leaders of the National Association of Manufacturers for their achievement in building a national platform for industry at the recent Manufacturers' Congress in New York. Sharp differences of opinion were reconciled, and the platform, despite several inconsistencies, is a constructive move that should prove conclusively to President Roosevelt that the manufacturers are ready and willing to cooperate with him in every sound measure for recovery. Further cooperation is to be expected from the joint meeting of representatives of the Manufacturers and of the Chamber of Commerce at White Sulphur which is now in session. Business and industry have long needed a policy on which they could unite. They now have a golden opportunity to establish it.

.CHIPS.

Washington—Roosevelt returns to Washington to get ready for Congress as his aides divide more sharply into two camps, spenders and non-spenders . . . Ickes reports that subsistence homestead organization can spend $500,000,000 to advantage . . . Admiral Standley asks for more men in report to Swanson . . . Crime conference at Washington is urged by Roosevelt to develop method of coordinating police functions of nation and local communities . . . Army will buy 110 attack and pursuit planes to cost nearly $2,000,000 . . . Labor will push unemployment insurance plan calling for 5 per cent payroll tax and minimum weekly payments of $15, will also demand 30-hour week . . . Roosevelt will ask legislation to "take the profit out of war," appoints Baruch and Johnson to draft program with aid of several Cabinet members . . . Senate investigating committee upset by move . . . Secretary Perkins says that report of her economic security committee will present alternative ways of accomplishing desired reforms, and that natural resources board will offer plan to provide employment for all for 25 years . . . Chairman Williams of NIRB forecasts dropping of price control features of NIRA, retention of maximum hours and minimum wage provisions and collective bargaining clause.

Foreign—French and German envoys sign agreement covering purchase of Saar coal lands if region votes return to Germany, and England, Italy and Czechoslovakia offer to send troops to help police plebiscite . . . Fall of Bolivian president follows military defeat by Paraguayans . . . Soviets execute 75 accused of complicity in terrorist plot, arrest many others . . . Corporative State plan for Spain proposed by Royalists and Fascists . . . Expulsion of Hungarians from Yugoslavia threatens trouble in Central Europe . . . Powers put on pressure to prevent serious trouble and League of Nations works out a compromise . . . European debtors decide to pay nothing now on war debts to U.S.

Finance—$900,000,000 Treasury finance offering heavily oversubscribed . . . HOLC will foreclose loans on which interest is defaulted . . . Third quarter RFC repayments exceeded new loans, another half-billion available to aid banks . . . Corporation net incomes increased in 1933, but individual nets fell off . . .Total of HOLC loans passes two-billion mark . . . SEC reports show that salaries of top officers of corporations have risen but little . . . Currency circulation increased in November . . . Banking law changes expected to be minor and to include provisions for uniform bank examinations . . . Chrysler buys minority interest in Commercial Credit Corporation.

Industry—Perkins found guilty in NRA code violation trial but will appeal . . . NAM asks that modified NRA be continued for one more year, and that Roosevelt name representative group to plan social reforms . . . Committees representing NAM and U S Chamber meet at White Sulphur to prepare industrial recovery plan . . . Ford announces plans to expend $8,000,000 more for machinery and equipment to bring recent total to over $19,000,000 . . . Bethlehem Steel delivers first of 18 de luxe day coaches to Norfolk & Western at Wilmington . . . New Haven runs demonstration train made up of old coaches and new streamlined models . . . Burlington orders another car for its 3-car Zephyr which is overcrowded . . . Japan buys 9 more ships for scrap . . . Dawes predicts sharp recovery for durable goods industries by July.

Indicators—Steel production increase accelerates and passes 33 per cent of capacity . . . Electric power output larger . . . Carloadings higher . . . Business Week's index rises over two points to 60.9.

Business Leaders to Coordinate Plans for Industrial Recovery

At White Sulphur Springs this week, a carefully selected group of business leaders, representing the National Association of Manufacturers and the Chamber of Commerce of the United States, is meeting to correlate the plans of these two organizations for business progress during the next few months. Cooperation between these two, not always cooperative bodies, should produce an interesting basis for the guidance of business forces in the critical months ahead. The meeting constitutes a highly important acceptance of the President's invitation to work under the rules so far evolved by the Administration, and should prove that cooperation and unity within the business community are possible.

Ground work for the White Sulphur Springs meeting was laid in a preliminary plan adopted last week at the Congress of Industry, in New York, sponsored by N.A.M. The program there presented will be matched with the recent referendum of the Chamber of Commerce to form the basis of a final recommendation. At the N.A.M. meeting last week, the atmosphere was constructive, with plenty of airing of individual viewpoints, but an overwhelming vote for cooperation with the Washington Administration in every decisive vote. The platform adopted, clearly based on the conservatism of the group, granted the need of planning, the importance of sound labor relations and the value of sane continuation of NRA and of a carefully studied relief program supported by municipal, state and federal governments.

At the annual dinner held in the Waldorf-Astoria Hotel, Donald Richberg emphasized the vital importance of cooperation, and invited a return to traditional American individualism in meeting the problems and opportunities of a new era. Dr. Virgil Jordan, former economist of *Business Week*, now president of the National Industrial Conference Board, presented what was perhaps the keynote speech. Dr. Jordan warned business that this was the last call and strongly urged the offering of a sound workable program of a "carefully and courageously laid road along which industry will undertake to move of itself, and a strong vehicle of unified organization of the productive groups of the American people in which to carry the rest along with it. This is the last call for recovery on the basis of private enterprise and unless it is answered decisively in the next six months, it will be too late."

The N.A.M. sessions were in sharp contrast with those held a year ago when General Hugh S. Johnson's warning business of its faults was met with many conflicting views. While the debates were vigorous last week, final decision effected remarkable unanimity for a receptive attitude to the overtures that the government is making.

The following officers of NAM were re-elected to serve for the ensuing year: president, C. L. Bardo; chairman of the board, Robert L. Lund; and vice-presidents, George H. Houston, president, Baldwin Locomotive Works, and Charles R. Hook, president, the American Rolling Mill Co.

New vice-presidents were elected as follows: F. W. Lovejoy, president, Eastman Kodak Co.; Walter J. Kohler, president, Kohler Co.; F. H. Willard, president, Graton & Knight; H. M. Bullis, vice-president, General Mills; W. D. Holliday, president, Standard Oil Co. of Ohio; C. S. Davis, president, Borg-Warner Corporation; S. Bayard Colgate, president, Colgate-Palmolive-Peet Co., and Robert B. Henderson, president, Pacific Portland Cement Co.

With the following, the officers will constitute the executive committee: W. H. Webster, chairman, Bridgeport Brass Co.; George McNeir, chairman, Mohawk Carpet Mills; W. Gibson Carey, Jr., president, Yale and Towne Manufacturing Co., and Malcolm Muir, president, McGraw-Hill Publishing Co.

MAPI Surveys Potential Machinery Requirements

In order to determine to what extent industry is delinquent in capital goods purchasing, the Research Division of the Machinery and Allied Products Institute has inaugurated a survey among machinery manufacturers to see what the builders of machinery themselves need in new machinery. For this purpose, MAPI has distributed report forms to its 900 members; early returns indicate that many millions of dollars' worth of machinery would be purchased were confidence restored with a sound governmental policy.

The prompt response in the return of reports indicates that generally machinery manufacturers are conscious of their requirements. An analysis of reports thus far received indicates a wide spread in their needs.

C. E. DAVIES

C. E. Davies is Appointed A.S.M.E. Secretary

During the anuual meeting of the American Society of Mechanical Engineers, the council of the Society appointed C. E. Davies as national secretary to succeed Dr. Calvin W. Rice. Since 1931 Mr. Davies has been executive secretary of the Society. He is a graduate of the Rensselaer Polytechnic Institute and began his professional career in the Smith Premier Works of the Remington Typewriter Co. He served as first lieutenant and later as captain in the Ordnance Department during the World War.

At the meeting also, a concise machine shop practice report was presented by R. E. W. Harrison, chief, machinery and agricultural implement divisions, Department of Commerce. In it Mr. Harrison enumerated new trends in design and application of production equipment. He also discussed briefly the economic situation and stressed the desirability of the *American Machinist* Survey of Metal-Working Equipment which was made in 1930 and will be duplicated in 1935.

Continuing his series of papers on metal-cutting tools, Professor O. W. Boston, University of Michigan, assisted by W. W. Gilbert, added to the data on this subject in a paper, "Relation Between Cutting Force, Temperature and Tool Life when Cutting Steel with a Single-Point Tool." This was followed by "The Formation and Function of the Built Up Edge," by Hans Ernst, research engineer, Cincinnati Milling Machine Co., who showed a number of moving pictures of segmental and shear chips during the period of actual formation. R. C. Deale, secretary, subcommittee on metal cutting data, told of the plans of the committee for publishing a series of handbooks.

Stocking of Dealers With 1935 Models Causes Rise in December Auto Output

DETROIT—As compared with R. L. Polk & Co. figures of 1,340,990 passenger cars and 211,598 trucks last year, 1,705,570 and 351,127 units respectively were registered the first ten months of 1934. The Department of Commerce states that the aggregate value of new passenger cars sold the first ten months of this year was 33 per cent above last year and 60 per cent above the same period in 1932. With 76,798 units estimated for November, members of the A.M.A. report 1,926,441 produced for the first eleven months of 1934.

December output is estimated at around 125,000 as compared with 84,000 last year though this figure is likely more of a guess than an estimate since new model output is always uncertain for the first few weeks. Hudson anticipates making 5,000 cars in December, gradually increasing output from 200 per day to 600 by the end of the month. Several other makers, including Dodge, Plymouth, Pontiac, Olds and Ford, are building for dealer stocks prior to formal announcements. All makers will have something for the show date. With no apparent hold-up this year the selling season will have a start over last year of several weeks. It is to be recalled that labor trouble in the tool shops and last minute engineering changes delayed some makes till after the first of last year.

Optimistic reports of anticipated increase in the new year's business is to be expected from sales managers and publicity directors at this season. A few straws in the wind substantiate these prognostications at present. Statisticians of company members of the A.M.A. after making predictions for their own companies, get together and swap stories; it is understood that their estimates indicate an increase in 1935 output over 1934 of from 10 to 50 per cent.

Castings for automotive dies are usually completed by November 15, but this year the picture is different; instead of business petering out new releases are currently being received, thus pointing to additions to the lines of several makers, already or shortly to be announced. This branch of the industry is consequently optimistic as to first quarter business and feels convinced that a real move is being made to stagger lines. Screw machine parts makers, pressed parts makers and others substantiate this view. As usual in this stage, these suppliers are being pressed for deliveries with price pressure even greater than last year.

Completely new ideas in machining methods which will reduce the number of operations rather than slight improvements on standard machines are receiving the attention of master mechanics and their managements. Even these improvements must pay out in about three months, instead of the life of the model, as used to be the general rule. More business than last year is reported by some machine tool makers but with less profit because of code difficulties. At least one large motor block line is to be completely overhauled early next year.

From present indications new cars are likely to show marked similarity in appearance, being a composite of the Graham apron fender, the La Salle narrow radiator and a rear line approaching that of the air flow models of this year. The Packard move, advancing the engine over the front wheels, also will find adherents. Two volume producers, Plymouth being one, will drop coil springs for the conventional type of suspension, using, however, a longer and softer spring. Studebaker new models use a transverse leaf spring for knee action without a front axle.

The Department of Justice, through the district attorney of western New York, asks the district court in Buffalo to enforce the Labor Board's ruling in the Houde Engineering Co. case. Among other things, it is requested to enjoin the company from bargaining with any other group than the United Automobile Workers, an affiliate of the A. F. of L., regarding wages and hours.

The Automobile Labor Board will shortly hold the first of a series of elections at the Cadillac plant under the plan to guarantee free choice of representatives for collective bargaining. Proportional representation is to be provided and the election is held under the supervision of the Board.

The automobile settlement of last March was the result of agreement between the parties while the Houde case was decided under the merits of the law as interpreted by the National Labor Board which accounts for the seeming disparity in government policy.

In any plan which may be adopted as a result of the code investigation consideration must be given to the impaired position of some industry units, to the failure of profits to follow increases in output and a like situation as far as productivity per worker is concerned. Staggering models between different companies will not increase steadiness of employment of the automobile worker as the same change over a period of time would be required and reduced prices on close out models would affect sales of newly introduced ones. A more hopeful plan, that of staggering models of the same company, which is receiving some play at present will prevent the dealer showing the complete line at once. However, some modification of the sales viewpoint will have to be made.

Chrysler has acquired a substantial interest in the commercial credit company handling installment financing of Chrysler and other makes of cars—General Motors will add a dealer committee to consult with its executive committee in policy formation—DeSoto will add a conventional model to the airflow line.

Meeting Held to Regularize Automobile Employment

Interested parties were given an opportunity to be heard on the possibility of regularizing employment and otherwise improving the conditions of labor in the automobile industry in meetings held in the Masonic Temple, Detroit, on December 15 and 16. No presentations were received relating to Section 7a of NIRA, and similar matters for which special boards are serving.

Leon Henderson, director of the research and planning division of NRA, presided. It has been announced that members of the staff making the study will be available at a number of other centers, at times to be announced later, to those who wish to present their opinions and who were not able to be present at the Detroit meeting. These other centers will include Buffalo, Cleveland, Dayton, Flint, Lansing, Milwaukee, South Bend and Toledo.

Bedaux Adopts Camera for Job Analysis

After a series of experiments, extending over the last three years, a new type of motion picture apparatus has been adopted by staff egineers of twelve Bedaux companies throughout the world. This equipment consists mainly of a camera which takes as many as 4,000 pictures a minute and a projector synchronized to within 0.001 min.

It is claimed that the apparatus accurately measures both the output of a man or a machine and the time required; reveals faulty manufacturing methods; discloses opportunities for the installation of time and labor saving devices; increases a worker's output without increasing the strain of his job. It is manufactured in compact portable form by the Eastman Kodak Co. exclusively for the Bedaux companies.

Industry Looks Ahead to Convening of Congress in January

WASHINGTON—Until President Roosevelt submits his recommendations to Congress on January 3, any estimate of the extent of the public works and relief program is nothing but a guess with the odds 9 to 1 that it is wrong. Thus did the President repudiate reports of huge expenditures which have been current in Washington for weeks. Most of them have been mere proposals which have no backing at the White House.

A canvass by FERA indicates that among the 4,300,000 families now on relief, there are 4,500,000 unemployed "employable" individuals. Approximately 2,000,000 of these are now engaged in relief work.

By executive order, the President has transferred $15,000,000 from the $525,000,000 drought relief fund; $5,000,000 to FERA for the purchase of submarginal land and $10,000,000 to the CCC for camps in the drought area. Transfer of a like amount from the CCC to the Department of Agriculture was authorized for the purchase of forest lands.

Both the Federal Trade Commission and the Commerce Department are fanning public sentiment on federal incorporation of interstate businesses as an expedient means of government regulation. The plan, long used in England, was in principle sanctioned by Congress in the China Trade Act of 1922 as a non-compulsory practice.

One of the most powerful members of the NRA administrative board is Sidney Hillman, president of the Amalgamated Clothing Workers Union and an official of the Recovery Administration's Labor Advisory Board. While organized labor has lost prestige in New Deal circles in recent weeks, through Mr. Hillman it has maintained a strong position within the Recovery Administration. It was because of his efforts that abolition of the trade service codes was delayed when their discard was almost a foregone conclusion.

In an address before the Wisconsin State Bar Association, Mr. Hillman broke his usual silence and outlined his views which are particularly interesting in that they indicate a strong labor school of thought which will be active in the battle over NRA's permanent structure. He announced that the open shop is doomed, that industrial unions are the best means of labor association, and that bargaining between labor and employers by its very nature involves a difference in objectives. This is in conflict with the theory that employers and employees have the same interests at stake and can thus associate as one big family.

A strong trend is developing within NRA for addition to the Recovery act of concrete provisions limiting the scope of the codes. This view, rapidly replacing earlier beliefs that the law should be extended by Congress in virtually its original form, has resulted from NRA's detailed study of conflicting code provisions which prove that the present 500-odd codes are virtually unenforceable.

Apparently there is only one solution of the problem. Objections which cannot be obtained administratively could be forced under the Recovery Act if the latter were made more specific. The much praised flexibility feature of the present law has resulted in a most inflexible administrative set-up.

Definite limits in the permanent law on just what features of business activity can be allowed in codes might open the way to limitations on price and production control and variations in wage and hour regulations, to say nothing of special rules on such matters as overtime work and accounting methods. On the matter of hours, NRA trend is centering more and more around the 40-hour week now provided in most codes as against labor's 30-hour demands.

Complete cooperation between Clay Williams, head of the NRA Board, and Donald Richberg, head of the National Emergency Council is indicated by Chairman Williams' statement that the collective bargaining, wages and code features of NIRA should be continued. Chairman Williams, however, made it clear that he is not talking about majority rule and would not go into any detail as to how collective bargaining should be interpreted.

Under Hiram Brown, formerly with the RKO Corporation and now special assistant to the NRA administrative officer W. A. Harriman, the Recovery Administration is mapping a detailed program for checking up on code expenses. The latest step is the issuance of an executive order calling for audit and periodic reports both to NRA and to the companies paying code assessments. Segregation of code authority funds from other monies is likewise provided.

• INDUSTRIAL REVIEW •

• Although machinery orders quieted down in some centers during December the machinery trade as a whole feels much better than it did a year ago. Inquiries are very active, and they look genuine. Supply business is better. 1934 was a better year than 1933, and 1935 promises to be better yet. Volume is still far below normal but the trend is upward.

• Arsenal orders for machine tools have done much to cheer up the distributors in New York, Boston and Philadelphia. Most of this business has now been awarded, but perhaps half a dozen items were not satisfactory to the purchasing board and will be readvertised. December bookings in Pittsburgh were about on a par with November bookings but the activity of inquiry is encouraging. Some orders may be closed this month but the majority will probably hold over until January.

• Machine tool orders placed in Detroit during the month were largely for special machines. Supply business continued to improve. Dealers there are concerned over their inability to make deliveries in case anything like normal demand develops. Stocks are very low. Toledo also reports some buying during this month. November levels are being maintained. In Indianapolis, on the contrary, December has been very slow. The general sentiment, however, is distinctly optimistic.

• While the last half of 1934 was disappointing in Cincinnati as compared with the first half, the year as a whole shows marked improvement over 1933 and prospects for 1935 are good. In St. Louis the third quarter slump was serious but the fourth quarter has shown a slow but steady recovery of most of the ground lost. The trade is feeling better. Rock Island Arsenal orders will help Chicago totals this month, but aside from these there has been some real activity. Distributors look ahead to a promise of better business in 1935. In Milwaukee December has been a disappointment, falling appreciably behind October and November. On the West Coast retail selling is not up to expectations. A few government orders have been about the only bright spots.

Photocell and Color Control Feature Olympia Machine Exhibits

LONDON—While British productions necessarily predominated at the Olympia exhibition, organized by the British Machine Tool Trades Association, American, German and Swiss exhibits were represented, at least as attempts to meet the requirements of British engineering; some few French and Swedish machines were also shown. Most tools did not exceed medium size, but a few were fairly large, such as a lathe for turning rolls 45 in. in diameter by 16 ft. long, a 4-ft. railway wheel lathe, and others.

Among the American exhibits were products of Pratt & Whitney, Bryant, Bullard, Kearney & Trecker, Heald, Ex-Cell-O, Gisholt, Warner & Swasey, Norton, Landis, Potter & Johnston, Fellows, Cincinnati Milling, Blanchard, Cleveland Hobbing, National Acme, Michigan Tool, National Automatic, Pellow, Brown & Sharpe, Lincoln Electric, Haskins, Barnes, Gleason, Wells, and others; among the American tools, now being built in Great Britain, were Waterbury-Farrel, Baird, Acme, Gridley, Cone, Potter & Johnston, Fay, and a range of Cincinnati milling machines, together with British-built Rockwell hardness testers, and English and German variants of the Fellows gear machines.

A number of figures have been suggested as to the total value of the exhibits and £1,000,000 appears to be the minimum. Rather tall estimates have also been made as to the number of machine tools on show, but a census by *The Machinist* (London) showed that, of machine tools proper, some 1,000 were included, 350 being brought in from overseas. The figures may perhaps make it evident that, despite changes in fiscal policy, Great Britain is still a market for high-production and specialized tools and, in short, for machine tools that are different. At the time of writing British exports in this line officially reported for 1934 are, all things considered, not greatly in excess of imports of foreign machine tools in money value.

The arrangement of the exhibition was the best ever experienced in London in connection with machine tools. The stands were not too crowded, the gangways reasonably wide, and the flag signs at the corners of the stands, which were alone permitted, gave clear indication of the names of the firms concerned, without causing any obstruction.

It was difficult to find a type of machine tool omitted, and the display of small tools and accessories was in keeping with the whole collection. The use of the electric drive was general, completely motorized machines being included, and this fact, implying reduction to a minimum in the use of belts, further enhanced the general accessibility and visibility of exhibits. The extension of hydraulic motions was apparent.

High Cutting Speeds Used

Some few demonstrations of cutting materials were included. For example, a British-made tungsten-carbide was turning cast iron of 255 Brinell hardness at 250 ft. per min., the depth being ¼ in., and the feed 47 cuts per in. Rectangular grooves in the periphery of the material ensured intermittent cutting. Similarly, cast iron of 180 Brinell was turned at 450 ft. per min., with cut and feed as before. Again, chrome-nickel steel was turned at 400 ft. per min. by ¼ in. by 33 cuts per in., finishing at 800 ft. per min. by $\frac{3}{32}$ in. deep by 161 cuts per in. On steel of 45 to 50 tons tensile finishing cuts $\frac{3}{32}$ in. deep were taken at 1,000 ft. per min. and in some instances at 1,700 ft. per min. A British-made high-speed type cutting material turned 30 to 35 tons tensile steel at 200 ft. per min., the cut being $\frac{5}{16}$ in. deep by eighteen cuts per in.; the finish with a molybdenum-titanium carbide tool was at 1,100 ft. per min., cut $\frac{1}{16}$ in. deep, and feed 168 cuts per in. A high-speed steel 1-in. drill running at 700 r.p.m. cut at a penetration rate of nearly 44 in. per min. through 3-in. thick, 30-ton tensile steel and also cast iron; a 4 by 4 in. milling cutter running at 92 r.p.m. took ¼-in. cuts at a feed of 15½ in. per min. One of the planers shown was designed to cut at 300 ft. per min.

One or two points noted in connection with grinding may be of interest. One is the application of the photocell to the size control of ground objects. A light ray is passed across the casing used, and the interruption of this by the arm of a gaging pointer actuates the control. The size is indicated on a scale and, if desired, the device can be used as an ordinary gage, a diamond-pointed finger making contact with the work. The claim is made that this electric eye is more constant in operation than mechanical or electrical contacts. In its present form this control is intended for use in the continuous infeed method of grinding, and the limits mentioned on batches of automatic work are plus and minus 0.000075 in.

Another development in grinding is in connection with automatic work on worm threads, the Durand process, of French origin, having been developed by an English firm. Here a wheel grinds on its outside diameter, the section at the operative part being of V form, to suit the thread desired. The axes of the wheel and work are at right angles, but the wheel is offset and thus clears the threads. The worm rotates and moves past the wheel and at the end of the stroke backs out and returns, the wheel being divided and the cycle repeated.

Again in connection with grinding, more particularly roll grinding, in one instance at least hydraulic operation has been displaced by electricity. Thus, in connection with the sliding movement of heavy rolls and at the slowest speeds of travel, it has been found that the hydraulic system results in movement that is too jerky, and in these circumstances the electric drive provides a more regular motion.

Note may be made of a method demonstrated which inverts the usual shrink-fit method and freezes the interior component, allowing it to expand when slipped into position. For this purpose solid carbon dioxide is used. The process is employed in connection with the liners of internal-combustion engine cylinders, pump barrels, the assembly of ball races, for fitting cast iron and steel parts in aluminum castings, and also for securing bushes in machine tool details. Excepting in the case of metallic tin, no deleterious effect has resulted from thus cooling the "shrunk" metal to minus 100 F.

Colors to Aid Operation

An innovation which roused more than an ordinary amount of interest was a system of color control for machine tools which made its first public appearance. Knobs of handles and levers controlling machine motions are colored according to function and the endeavor has been made to standardize a scheme. Thus the knob of a lever connected with hand motion is black. Similarly, a lever for the engagement of power feed is gray, a reversing lever blue, a locking lever brown, a quick traverse cream, a screw-cutting lever purple, and a start-and-stop lever red, while levers controlling what may be described as variable quantities, as for instance, speed and feed changes, are mottled, the colors being orange and green respectively.

Then, in place of the familiar index plates showing lever positions for various speeds and feeds, disks or cylinders may be used, adjusted by hand to show through windows color symbols which indicate the position or positions with the same color symbols to which the corresponding machine lever or levers must be set in order to obtain the required result. Thus in a horizontal boring and surfacing, machine, in place of a speed plate a disk about 6 in. in

diameter bears a series of color symbols which become visible through windows as the disk is turned to the position which indicates by pointer the speed desired. Four color designs are used, green, red, yellow and blue, each indicating a color position of the corresponding wheel or handle for the speed set.

S. Clay Williams Predicts End of Price Fixing

In his first public address since his acceptance of the chairmanship of the National Recovery Board, which has taken over many of the responsibilities formerly held by General Hugh S. Johnson, S. Clay Williams advocated that, at the expiration of the National Industrial Recovery Act, provisions governing child labor, maximum hours, minimum wages and collective bargaining be retained but that price fixing be dropped. The occasion was a luncheon given at the Hotel Astor, New York, by the American Arbitration Association, the Chamber of Commerce of the State of New York and the Merchants Association of New York in honor of Mr. Williams, who is on leave of absence as president of the R. J. Reynolds Tobacco Co.

Some measures for the prevention of unfair trade practices and some degree of cooperation between manufacturers could be retained, but Mr. Williams felt that recovery was not promoted by "putting a floor under prices." He pointed out that the same objective could be gained by eliminating labor as an element in competition.

Implement Exports Gain During Ten-Month Period

Export trade in agricultural implements gained 86 per cent during the first ten months of 1934, compared to the corresponding period of 1933, according to the Department of Commerce. The totals were $18,121,395 in 1934 and $9,739,464 in 1933.

Valued at $9,952,838 during the ten-months' period, foreign shipments of tractors and parts had a gain of 104 per cent over last year. Shipments of wheel tractors amounted to 4,517 units, valued at $3,249,834, compared with 1,910 units valued at $1,470,033 in the first ten months of 1933, a gain of 136 per cent in volume and 121 per cent in value. Tracklaying tractors likewise showed a large gain amounting to 2,009 units, valued at $3,835,978, as contrasted with 842 units valued at $1,480,-091 for last year, an increase of 139 per cent in number and 159 in value.

November Tool Orders Show Big Improvement

November figures recently released by the supervisory agency of the Machine Tool and Forging Machinery Industry show a gain of over 19 per cent above October. The index of 52.4 represents the largest volume of orders placed in any month since April, 1931, with the exception of last December and January. Both domestic and foreign sales contributed to the improvement. The index of export orders for November reached 9.3 compared to its low point in September of 6.8. In two months the industry has regained the ground lost during six months of gradual recession during the first half of the year.

Distribution of new business is about the same as for October. Only a third of the companies reporting are doing more than the average volume of business represented by the month's total index; almost half report less than 30 per cent of their 1926 volume. As a group the smaller companies are not faring as well as the larger ones. The index of 40.8 for group B companies is an improvement over October, but remains under the August and September figures.

Providence Engineering Society Has New Home

During the dedication of its new home, the Providence Engineering Society received the unexpected good news that the building and its furnishings are entirely free of debt. This was made possible by the generosity of the family of the late John R. Freeman, a noted civil engineer. The Freeman family, besides paying off the mortgage and all outstanding bills, donated a library as a memorial. The Society's building is a two-story brick structure, formerly used as a telephone exchange. Besides the library, the second floor contains an auditorium capable of seating about 300 persons.

Table I—Index of Orders Based on Volume of Shipments for 1926

Month	Index of Orders			3 Months' Average Index	% Foreign to Total Orders
	Domestic	Foreign	Total		
January	43.9	9.8	53.7	56.5	18
February	40.5	10.4	50.9	48.2	20
March	40.1	8.0	48.1	50.9	17
April	36.2	10.3	46.5	48.5	22
May	35.4	10.5	45.9	46.8	23
June	27.4	7.9	35.3	42.6	22
July	26.3	8.4	34.7	38.6	24
August	32.4	9.0	41.4	37.1	21
September	29.4	6.8	36.2	37.4	19
October	35.1	8.8	43.9	40.5	19
November	43.1	9.3	52.4	44.2	17

Table II—By Size of Companies

Group A—Companies reporting year's sales in 1926 of $200,000 or more:

Month	Index of Orders			No of Reports	% Foreign to Total Orders
	Domestic	Foreign	Total		
January	43.5	10.5	54.0	82	19
February	39.5	11.2	50.7	82	22
March	38.8	8.4	47.2	82	18
April	35.3	10.9	46.2	89	24
May	34.6	11.2	45.8	88	25
June	26.8	8.3	35.1	90	24
July	25.8	8.9	34.7	90	26
August	31.4	9.6	41.0	93	23
September	28.7	7.1	35.8	94	20
October	34.9	9.4	44.3	96	21
November	43.4	9.8	53.2	89	19
Group B—Companies reporting year's sales in 1926 of less than $200,000:					
January	48.3	1.5	49.8	81	3
February	50.6	2.4	53.0	81	5
March	54.7	2.6	57.3	81	5
April	48.2	2.1	50.3	74	4
May	46.4	1.6	48.0	72	3
June	33.9	3.5	37.4	76	9
July	33.3	1.9	35.2	82	5
August	44.7	1.0	45.7	76	2
September	39.4	3.1	42.5	81	7
October	37.5	1.7	39.2	82	4
November	38.7	2.1	40.8	82	5

Table III—Distribution of Orders

(Shown by indexes of individual companies)

New Orders in % of 1926 Shipments	Number of Reports in Each Index Group										
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.
200 or more	7	4	4	6	4	2	3	6	3	5	4
100–199	14	16	17	15	12	10	9	8	12	15	15
90–99	8	4	5	4	4	0	2	5	2	3	4
80–89	7	5	6	3	5	8	3	7	5	3	4
70–79	4	4	7	2	6	5	2	3	6	6	7
60–69	5	6	12	5	11	10	12	9	2	9	9
50–59	5	13	6	19	12	7	8	12	9	12	12
40–49	20	14	9	19	10	9	13	14	15	8	16
30–39	14	14	19	17	22	24	22	18	16	19	16
20–29	22	20	27	20	22	25	29	23	24	26	17
10–19	27	25	23	22	33	21	26	27	29	31	23
Less than 10	30	38	28	31	19	45	43	37	52	41	44
Total reports	163	163	163	163	160	166	172	169	175	178	171

Leipzig Fair Date Set

The Leipzig Trade Fair will be held at Leipzig, Germany, from March 3 to 10, and more than 8,000 exhibits will be contributed by a score of leading countries, including the United States. Advance bookings indicate an attendance of 100,000 business men from 72 countries. A special effort is being made this year to extend international trade relations with foreign countries.

• BUSINESS ITEMS •

Hardinge Brothers, Inc., Elmira, N. Y., has established an office at 544 West Washington Blvd., Chicago, Ill., where a display of precision bench lathes, milling machines, hand screw machines and collets for lathes and milling machines will be housed. HENRY C. LAUX and EDWARD A. IVERSON will be in charge.

Joseph T. Ryerson & Son, Inc., is completing an extension to its Milwaukee plant at 244 South 19th St., the plant being extended almost twice its former length. A new heating system has been installed to prevent condensation of moisture that would spoil the quality and finish of special sheets, bars and other products.

The tungsten-carbide die, tool and specialty department of the Bissett Steel Co., Cleveland, has been reorganized and will be operated as a separate corporation known as The Tungsten Electric Corp., Bissett Steel Division. Manufacturing and sales will be handled by the same personnel as previously. A branch manufacturing plant has been built in Chicago and is now in operation. For the present the Bissett Steel Company branch warehouse in Cincinnati will be the Cincinnati headquarters for the new corporation.

The Brown Instrument Co., Philadelphia, has been consolidated with the Minneapolis-Honeywell Regulator Co., becoming a subsidiary, but operating as a separate company with sales and service as formerly. Research, development and engineering will be coordinated. RICHARD P. BROWN will continue as president of Brown Instrument and will become an officer and director of Minneapolis-Honeywell.

The Gammons-Holman Co., Manchester, Conn., manufacturers of spiral reamers and special cutting tools, has declared a Christmas bonus of 1 per cent of the total year's earnings of each individual in the organization. There has been an average increase of $275 in the yearly wages per man over 1933.

• OBITUARIES •

J. R. VANDYCK

Pioneer Machine Tool Dealer Dies

James Rutherford Vandyck, 63, president of the Vandyck Churchill Company, New York machine tool dealer, died December 11 after a heart attack. He became president of the company in 1904, when it succeeded the original J. R. Vandyck Company established in 1901. At the time of his death Mr. Vandyck was secretary of the Associated Machine Tool Dealers, of which he had been president, and was also chairman of the regional board of the Supervisory Agency of the Machine Tool and Equipment Distributing Trade. During the war he had supervision of the shipment out of this country of all classes of machine tools and machinery, being then in association with Vance McCormick, chairman of the War Trade Board at Washington. Mr. Vandyck was a charter member of the Machinery Club of New York and a member of the Engineers' Club.

Mr. Vandyck will be remembered for his ability as a salesman and for his integrity, which was a byword in the trade and among his customers. Sound judgment from years of experience in handling the problems of the machine tool distributing trade had placed him in the position of being a stabilizing influence. Above all these things, he was held in high regard by his friends and associates.

THOMAS A. WATSON, 80, builder of the first telephone instrument, and the first to hear a voice over the device, that of the inventor ALEXANDER BELL, died Dec. 14 from heart disease.

JOHN P. FRAZIER, 84, founder of the Franklin Sucker Rod Co., and the Franklin Portable Crane & Hoist Co., Franklin, Pa., died recently.

J. FORREST HAHN, vice-president and treasurer of the National Enameling & Stamping Co., Milwaukee, Wis., died on Dec. 1.

EARL C. MAXWELL, president of the Maxweld Corp., Brooklyn, N. Y., manufacturer of welded tanks, died Dec. 7, at the age of 54.

• PERSONALS •

HOWARD COONLEY, president of the Walworth Co., representing the A.S.M.E., was re-elected as president of the American Standards Association. FREDERICK E. MOSKOVICS, representing the S.A.E., was re-elected vice-president.

C. PARKER HOLT has been made executive vice-president of the Caterpillar Tractor Co., Peoria, Ill. THOMAS J. CONNER has been made vice-president in charge of manufacturing and has been elected a director to fill the vacancy caused by the recent death of PLINY E. HOLT.

ALLAN SEYMOUR, sales engineer of the Grinding Wheel Division, Norton Co., Worcester, Mass., has been appointed manager of the Philadelphia office.

• MEETINGS •

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Annual meeting, Dec. 27 - Jan. 2. Pittsburgh, Pa. HENRY B. WARD, permanent secretary, Smithsonian Institute Bldg., Washington, D. C.

AMERICAN ENGINEERING COUNCIL. Annual meeting, Jan. 10-12. Washington, D. C. FREDERICK M. FEIKER, executive secretary, 744 Jackson Place, N. W., Washington, D. C.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Winter convention, Jan. 22-25. Engineering Societies Bldg., New York. H. H. HENLINE, national secretary, 29 West 39th St., New York, N. Y.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS. Annual meeting, Jan. 28-30. Buffalo, N. Y. A. V. HUTCHINSON, secretary, 51 Madison Ave., New York, N. Y.

SOCIETY OF AUTOMOTIVE ENGINEERS. Thirtieth anniversary dinner, Jan. 7. Hotel Commodore, New York. Annual meeting, Jan. 14-18. Book-Cadillac Hotel, Detroit. JOHN A. C. WARNER, secretary, 29 West 39th St., New York.

American Machinist

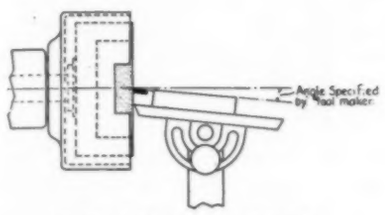
REFERENCE BOOK SHEET ©

Grinding Cemented-Carbide Tools

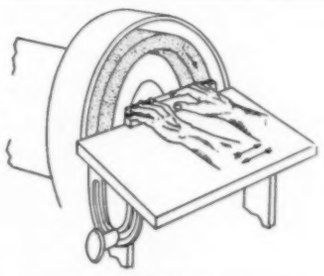
Single-Point Tools—I

Courtesy of The Carborundum Company

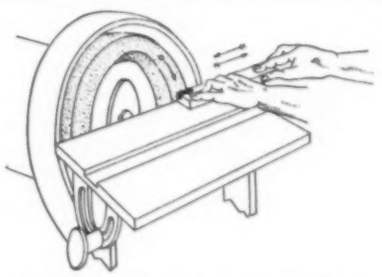
Side Grinding



1. Set table to correct angle.



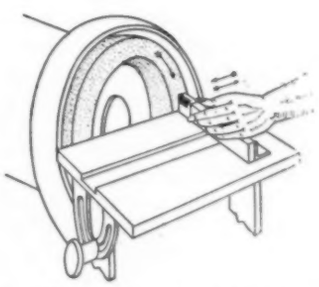
2. Rough grind side clearance.



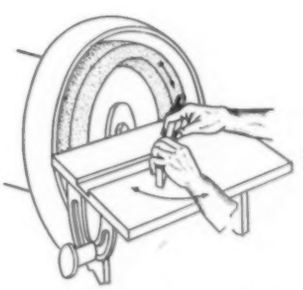
3. Adjust table and rough grind top rake.

5. Adjust table and finish grind side clearance.
6. Adjust table and finish grind top rake.
7. Adjust table and finish grind front clearance.

NOTE: The above procedure is for a right hand tool. The order for a left hand tool is, top, side, front. The order is merely so that the operator can better watch the grinding. Some may prefer to grind the front first, the side next, and the top last.

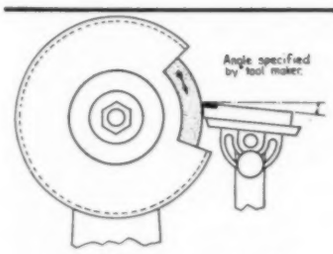


4. Adjust table and rough grind front clearance.



8. Finish grind radius on nose.

Rough Grind on Periphery—Finish Grind on Side



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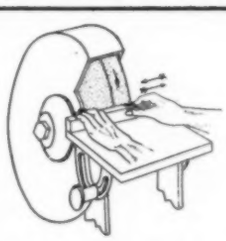
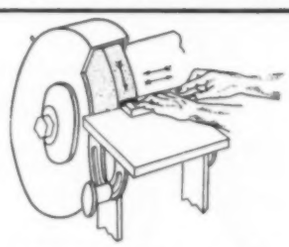
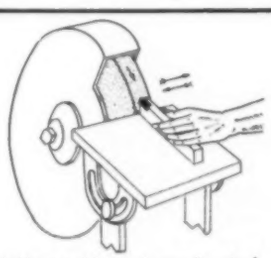


2. Rough grind side clearance.

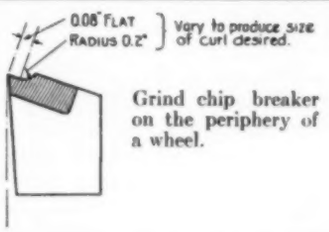


3. Adjust table and rough grind top rake.

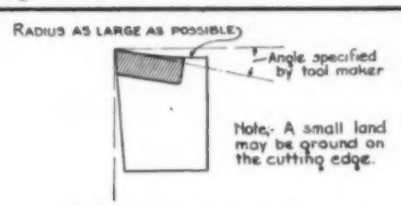


4. Adjust table and rough grind front clearance.

Grinding Chip Breakers



Grind chip breaker on the periphery of a wheel.



An alternate method of grinding chip breaker.

Special wheels are required for grinding cemented-carbide tools. Side grinding on cup or ring wheels avoids hollow grinding the clearance angles. Rough grinding on the periphery of a plain wheel and finish grinding on the side (see set-ups in Figs. 2, 3, 4 and 8 under side grinding) is faster than side grinding for both operations. Care should be taken to remove all the undercut on the tip, although some undercut may be left on the shank.

Chip breakers may be ground freehand on the periphery of a grinding wheel. The back rake, or top side rake if one is ground, must not be too great or weakening of the cutting edge will result. A slight land at the cutting edge may be necessary on some tools for some operations.

42 Holes in a Motor Cover

C. W. HINMAN

A COVER for a motor for a household appliance is represented by the illustration. It is made in a press in three operations from 0.0375-in. drawing steel.

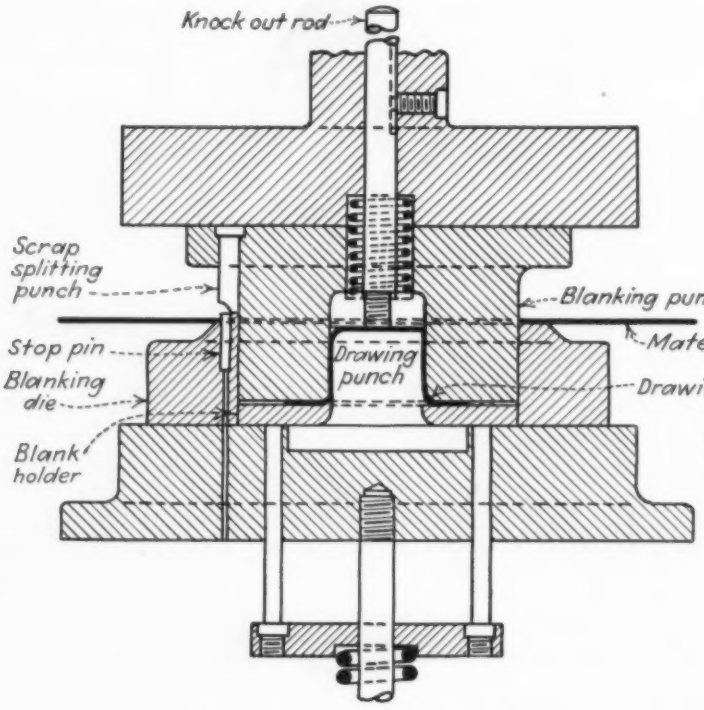
The first operation is performed in combination blanking and drawing tools. The blanking die is the lower member and is attached to the die-shoe. Within the die is a centrally located, positive drawing punch having a diameter coincident with that of the inside of the cover. An annular, spring blank-holder surrounds this punch within the die. When the ram descends, the blank is cut by the blanking punch attached to the punch holder. As the ram continues its descent, the drawing punch within the die draws the blank between the faces of the blanking punch and the blank holder and up into a concentric opening in the blanking punch, the opening being of the same diameter as that of the outside of the cover, and its entering edge is rounded for a suitable drawing radius. Within this opening in the punch, a spring pad is in positive contact with a knockout rod, which projects above the punch stem. As the ram ascends, the blanking punch carries up the drawn work within it. The blank holder follows and strips the cover from the drawing punch. The upper end of the knockout rod positively contacts in the press head and ejects the cover, which falls behind the inclined press.

The cover is drawn 1¾ in. deep, leaving a flat, concentric rim 4⅛ in. diameter attached. This rim includes the four ears *A* with the four segment arcs *B* between them. Along these contours the second operation, or trimming, is done. This operation is one method of trimming irregular ends from drawn shells without using a Brehm trimmer. The trimming die is attached to the die-shoe and the general design is identical with that of the tools for the first operation. An exception is the height of the positive drawing punch, which extends above the face of the die 1¾ in., or the depth of the first draw. The trimming punch, above the die, trims the arcs and ears and finishes the draw by straightening out the shell around the drawing punch from the lines C-C. When the ram ascends, the same stripping action occurs as described in the first operation, including the action of the knockout rod.

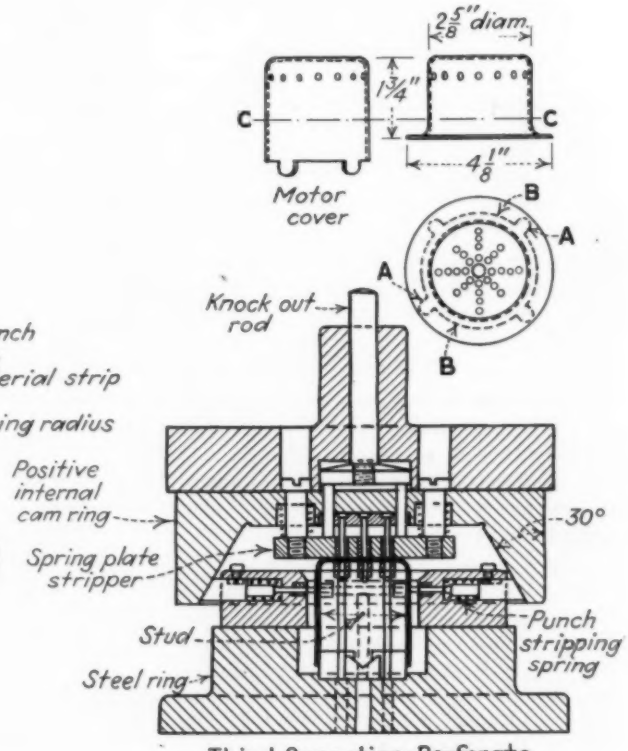
In the third operation, the 13 side holes and the 29 face holes are pierced. The tools are of the side cam type and all the holes in the die are bushed. The cover is placed over a close-fitting stud attached to the die-shoe. A suitable steel ring around the placed work carries thirteen horizontal sliding punches, each having a positive stop. Stiff springs are arranged to strip these punches.

The punch plate carries 29 vertical piercing punches, surrounded by a spring plate stripper that is actuated by a positive knockout rod. Around the vertical punches is a positive steel ring having an internal opening tapered outward 30 deg. from the vertical center line. The face of this opening is down. As the ram descends, 29 holes are pierced in the end of the cover. As the ram continues its descent, the tapered ring forces the thirteen horizontal punches inward, punching the side holes. The stripping action is the same as in the other operations.

The output from the tools was well over 100,000 covers annually.



First Operation-Blank and Draw
Motor Cover



Third Operation-Perforate
13 Side Holes and 29 Face Holes
Motor Cover

Estimating on Fixtures, Tools or Machines

JOHN R. GODFREY

"WE ARE inclosing a blueprint of a new fixture for our work. How much will you charge to make it?"

All well known contract shops get many similar letters, after which their troubles begin. First, the estimator gets busy.

The work of this important individual is so varied that long experience is necessary for real success. He must not only be familiar with cutting speeds of different operations but must determine how heavy cuts the pieces will stand without springing and how they can be held and he must know the equipment in the plant on which they can be handled. The successful estimator is no wizard, as some would have us believe, but he must have good judgment that will enable him to see what obstacles are to be avoided and what short cuts can be taken.

Neither is he a mind-reader, or clairvoyant, as might be inferred from the lack of essential information contained in many inquiries. All too frequently specifications designate materials by a number or special symbol which has no significance outside the plant in which the inquiry originates and the estimator is left with no recourse but to guess at the requirements, or to write for further specifications and complete analysis. Such procedure necessary to a proper estimate, results in a delay in quoting, or irritation to the customer, both of which might have been avoided if suitable information had accompanied the original inquiry.

Even more frequently encountered, and equally difficult for the estimator, are vague specifications which the estimator is not in a position to solve. "Use alloy steel" or "this part to be made from Stainless Steel" are notes often found on drawings which mean little or nothing to the man who must quote, because there are innumerable varieties of alloy steel, and nearly as many kinds of Stainless Steel, all of which have very definite characteristics and properties, no two of them alike.

One of the first requisites for accurate estimating is, according to a veteran who has a very successful record, a good drawing or blue print and a complete parts list. Some customers send carefully made drawings or good, clear prints and a very complete list of parts. Others are very indifferent as to the legibility of the prints and send no lists of parts, both of which add to the cost of estimating and the trials of the estimator. If no lists of parts are given they must be made up from the drawing before estimates can be made.

Points to Consider

Having the list of parts and the number of each, the estimator studies each part in turn to determine just how it can best be made. Among his problems are:

What operation should be done first to secure a working surface or locating points?

How can this operation be done best, and on what machine?

How heavy a cut can be taken and at what speed? Must the surface be scraped, if flat, or ground and lapped, if round? These answers will help to determine the time of this operation.

How can the piece be held for future operations to avoid springing or permanent distortion?

The cost of materials used must also be carefully considered. If castings must be made how much will the patterns cost?

In order to know material costs, weights must be determined by calculating the volume and knowing the weight of the material per cubic inch. Similarly, the cost of machining involves finding the volume of metal to be removed and the rate at which this can be done. Speed and feed tables are useful as a basis for calculation but they can rarely be used without severe modification to suit the conditions involved. This is another point at which the experience of the estimator is invaluable.

The veteran estimator in question bases his machining time on the cubic inches of metal to be removed and his experience enables him to arrive at the required time in short order. Drilling time is determined by his knowledge of good shop practice and of the equipment available. Every piece is gone over in detail and a time allowed for each. The total gives the time for the whole fixture. Multiplying this time by an hourly rate which covers machining time, overhead and other necessary charges, gives the total cost estimate.

Before sending out the estimate, however, the shop foremen who handle the job are called into consultation. They discuss the methods of machining on which the estimates were based and suggest better methods if possible. In some cases alternate methods may be advisable in case certain machine equipment is tied up on other work. Occasionally the foreman have novel ideas as to machining that materially cut the time required. Complete cooperation between the shop and the estimating department is necessary for best results.

This consultation enables the foremen either to agree with, or object to, the time allowed by the estimator for each part or for the fixture as a whole. If the foreman can make good his objection to the time the estimator can modify it as seems necessary. If, on the other hand, the foreman suggests a method which will reduce the time, the estimated cost can be correspondingly reduced, increasing the chances of getting the order. These consultations before the estimates go to the customer have proved invaluable in this plant.

Needless to say a good estimator must have a thorough practical knowledge of the various operations involved and how they are performed. This knowledge must include the materials used, methods of laying out work, how it can be checked or otherwise held in the machine, and the time required for these preliminaries as well as for the machining operations themselves. As no two jobs are alike, and in fact may vary through wide limits, hard and fast rules are of little value. What really counts is a fundamental knowledge of shop practice and judgment that is flexible enough to visualize the many variations involved. For this reason it is to be expected that the most successful

estimators are usually men past 40. Where, however, young men have been specially trained in this work their ages may be found considerably below this mark. Here is a place, however, where there is, or should be, no age limit. Those who retain even fair health and mental alertness can and do make successful estimators.

Careful estimating is just as important to the customer as to the bidder. When quotations vary widely the customer will do well to consider the source of the various bids. Extremely low quotations are frequently dangerous to all concerned. While they hasten the failure of the low bidder they also injure the reliable shop on which the customer must depend for satisfactory work year after year. The customer should consider past performance as to delivery and satisfaction before placing the order with the low bidder who is unknown. Delays caused by the possible rejection or failure of the tool can easily cost much more than any saving in first cost.

Getting the Most From Your Turret Lathes

WARNER SEELY
Secretary, The Warner & Swasey Company

Under certain conditions it is the practice of The Warner & Swasey Company to send a demonstrator to a plant which is installing new turret lathe equipment. It is his duty to give such instruction as will allow the company to get the maximum production and profit out of the new machine tools it has just purchased.

The reports turned in by these demonstrators are always interesting because they give an accurate cross-section of machine tool methods as employed on the job. After studying hundreds of such reports one comes to the conclusion that while some shops are conspicuous for the efficient and profitable way in which they use their machine tools, others, and they are in considerable numbers, are getting only a portion of the return on their investment to which they are entitled.

For instance, recently the following report came in covering a visit to a large manufacturing plant:

The concern had purchased a new turret lathe some time previously for finishing fiber gears. This consisted of facing, boring and turning the outside surface. At that time the operator had been instructed in the best possible practices and was turning out a unit in slightly over two minutes.

On the second visit, it was found that the original operator had been transferred and his place taken by an expert engine lathe hand. It appeared that no one had instructed him in the operation and set-up of a turret lathe. As a result, he was using the square turret only, and entirely overlooking the possibilities of the hex turret, although tools were readily available for both of them.

The result was that the production time had been increased by two minutes per unit or nearly doubled. After an hour's explanation on the part of the demonstrator the new man was back on the old schedule, but for more than two months that turret lathe had been operating at half capacity.

In a much smaller shop, for these conditions are by no means dependent on the size of the organization, one of our demonstrators found a turret lathe that was in operation for two shifts each day. The job was a simple one and had excellent production possibilities. After watching the lathe in operation, the demonstrator did a few calculations and found that the time per unit could be reduced by five minutes through the use of a few standard tools which could be purchased from a catalog. The savings paid for the tools in a short time.

These are only two of many similar incidents that force a conclusion with which many may, perhaps, not agree. That conclusion is that even the most skillful and highly trained mechanic may well be given certain fundamental instruction before he starts operating a specialized machine tool, whether it be turret lathe, milling machine or grinder.

Back of every machine tool there are definite reasons for its individual design and construction, and the operator is unable to get the most out of it unless he is thoroughly familiar with these reasons.

As one method of meeting this condition, it is possible that certain fundamental instructions be given machine tool operators which will insure the efficient, profitable operation of those machines.

For instance, what should the operator know about turret lathes which will enable him to accomplish that desirable result?

What the Operator Should Know

1. Devote a half hour or an hour in explaining the fundamental differences between the engine lathe and the turret lathe, the single station and the two station lathes. Why are there three types? What kind of work can be turned out best on each?

2. Discuss the all-important question of set-ups. True these are frequently a process of evolution. As a job continues day after day certain short cuts are discovered and put into use.

But there are fundamental facts that can be universally applied. The instructor might take a specific job and show the possible tool combinations and what each will do. A record should be kept of each job which shows not only the tools used but also the feeds and speeds. This will prove invaluable for future use.

Set-ups on a turret lathe are interesting to work out because there are frequently several ways in which the job can be done. The use of imagination is sometimes required to work out the best possible solution.

3. Is the problem of cutters. Why are there both stellite and cemented tungsten-carbide cutters? Why should one be used on one type of material and for certain kinds of work in preference to the other? How should cutters be ground?

4. Coolants and their use. Why are there dozens of types of coolants, and why is one adapted to a certain job instead of another? For instance, one of our demonstrators was watching a bar job in which a sulphur base oil was used as a coolant. The production was ten pieces per cutter grind. A change in the coolant brought this up to between 25 and 30.

5. The right machine for the right job. Another illustration will indicate the possibilities of this section. A concern was making a strainer about 2½ in. in diameter. A large saddle type turret lathe was being used. A much smaller ram-type machine would have increased the production by from 200 to 300 per cent.

Some of these ideas for the improvement of turret lathe production may sound primary, and still, judging from our own experience, there are large numbers of shops in which such a course of instruction, even on the company's time, might be given with real dollars and cents profit.

NEW BOOKS

★ ★ ★

DICTIONARY FOR METALLURGISTS. *Part II—English-German. By Henry Freeman. 347 pages, 7x5 in. Published by Otto Spamer Verlag, G.m.b.H., Leizig, Germany. Price 25 Rmk.*

Part I of this dictionary was devoted to German-English translations, and Part II under consideration covers English-German equivalents. In compiling this volume the author has aimed at providing under one cover sufficient material to enable ready translations of technical literature without resort to a dictionary of more general terms. Hence, it contains much that is essentially non-technical, but the inclusion of this matter is justified on the grounds of convenience.

The vocabulary covers 33,000 words and technical terms which are more than sufficient for all ordinary work. American spelling is preferred throughout the book. In addition, to the vocabulary the compiler provides useful conversion tables.

★

MACHINERY'S HANDBOOK. *Ninth Edition. Erik Oberg and Franklin D. Jones, Editors. 1592, 4½x7-in. pages. Published by the Industrial Press, 148 Lafayette St., New York, N. Y. Price, $6.*

In the ninth edition of this well-known handbook there are 172 revisions and improvements that range from new sections to small changes in data made imperative by improved knowledge or technique. Major revisions consist of the following: new strength of materials data; load capacities of ball and roller bearings; recent developments in plain bearing design; new tables and information on designing different classes of gearing, including spiral bevel and hypoid gears; revised SAE standards; additional screw-thread data; standard milling cutters; a new section on roller-chain transmission; revised speed and feed data including actual practice on cemented-carbide tools; new standards for taps, gages, and milling cutters; electric motor characteristics; die-casting compositions; and others. The handbook is divided into 126 main subjects, and the items in these main divisions can be located by referring to a complete index. A special thumb index aids one in opening the book to any one of the fourteen main sections most frequently consulted.

DIE-CASTINGS. *Herbert Chase. 256 pages, 6x9 in. Profusely illustrated. Black clothboard covers. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y. Price, $3.50.*

This reference book shows typical die-castings and products made from die-castings in a chapter including more than 120 illustrations. Alloys for die-castings are discussed, giving tables of physical properties, advantages and disadvantages of each material, including specific information on the most suitable alloy for a given application. Zinc, aluminum, copper, tin, lead and magnesium alloys are included. In the latter half of the book, die-casting design, alloy specifications and finishes are presented in terms of practical designs. Detail drawings for 30 die-castings, mostly machine parts, are reproduced, including parts cast from all die-casting materials. Tests and specifications for all standard alloys, and various types of plated and surface finishes are included.

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TWENTY QUESTIONS ON THE ECONOMIC SECURITY OF THE PEOPLE. *A study outline prepared by the Industrial Department of the National Council of Young Men's Christian Associations, 347 Madison Ave., New York, N. Y. 48 pages, 6x9 in. Bound in paper covers. Price 25 cents.*

For anyone who wants to clarify his ideas on social legislation, including such items as unemployment insurance, old age pensions and health insurance, this pamphlet which is organized on a question and answer basis should be helpful. It covers the experience of European countries and outlines their laws, as well as giving state laws in this country. The booklet has forewords by Secretary Perkins and by C. L. Bardo, president of the National Association of Manufacturers.

★

TOOL STEELS. *By James P. Gill, chief metallurgist, Vanadium Alloys Steel Company. 136 pages, 6x9 in. Paper bound. Illustrated. Published by the American Society for Metals, 7016 Euclid Ave., Cleveland, Ohio. Price $2.00.*

Those who had the opportunity to attend Mr. Gill's five lectures during the 1934 Metal Congress will welcome the opportunity of obtaining this permanent record of the subject matter of this course. The educational experiment was highly successful, and the choice of subject and lecturer a happy one.

Tool steels in this volume are classified into fourteen general groups with a brief discussion of methods of their manufacture and testing. Then each group is described in some detail with special emphasis on such characteristics as hardness, toughness, resistance to wear, resistance to softening at high temperatures and depth of case. The result is a concise but comprehensive picture of this group of steels which avoids highly technical metallurgical sidelights.

★

INDUSTRIAL FURNACES. *Volume I, Third Edition. W. Trinks, Professor of Mechanical Engineering, Carnegie Institute of Technology. 456, pages, 6x9 in. Indexed and illustrated. Cloth binding. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y. Price, $6.00.*

Since Professor Trinks first published his work *Industrial Furnaces* in 1923 the design and operation of this class of industrial equipment have undergone extensive changes. At that time furnace design was primarily an art based on experience and a general understanding of the conditions encountered.

During the intervening years the use of industrial furnaces has been greatly extended until today both their design and operation have become a science. This means that theoretical considerations must be evaluated, and Professor Trinks' book supplies tables and graphical methods that greatly simplify the problem.

Furnaces discussed in this volume are those which raise the temperature of metal without effecting chemical change or changes of state. Equipment for melting steel and glass does not come within the scope of this definition.

High-Speed Tool Tips Discussion

O. D. BRADSHAW
Fredericton, New Brunswick, Canada

Referring to the article under the title given above (*AM*—Vol. 78, page 676), I would like to state that in addition to better heat-conductivity of carbon steel shanks of tipped tools, they have better resistance to shock on account of the larger grain structure of annealed carbon steel, as compared to annealed high-speed steel, thus producing a cushion effect and absorbing the shocks sustained at the tip. This is especially true in taking roughing cuts. Another advantage is the saving in high-speed steel.

• IDEAS •
FROM PRACTICAL MEN

Set-Up for Broaching Helical Keyways

FRANK HARTLEY

In some heavy-duty machines the shafts have integral keyways, and in special cases, they are helical. While helical keyways can be broached almost as easily as can straight ones, the set-up is more expensive. In the illustrations are shown details of the set-up for broaching two diametrically-opposite helical keyways. No attempt has been made to show the details of the broach. The teeth are of the usual type and are cut on helical ribs.

Referring to Fig. 1, the work indicated in heavy dotted lines is held in a hardened bushing in the fixture *A* and is located by the pin *B* engaging a slot in the hub. The broach has two diametrically-oposite grooves in which the flatted ends of the pins *C* engage, causing the broach to rotate as it is pulled through the work. These pins are held with their flatted ends in the grooves by the flat springs *D*, the flats being kept in line with the grooves by the small pins *F* engaging slots in the fixture.

When the broach is to be removed for loading or unloading the work, pins *C* are pulled out of engagement with the grooves in the broach and are turned so that the small pins *F* rest on the surface of the fixture. When the broach is put back, the flat springs snap the flatted ends of the pins into the grooves when pins *F* are in line with the slots in the fixture.

Referring to Fig. 2, the broach is held in the holder *A* by a slot in the pin *B* engaging flats on the shank. This pin is prevented from falling out as the broach rotates by the snap pin *C* engaging a circular groove in its body. The part of the holder attached to the drawbar of the machine is shown at *D*. Interposed between parts *A* and *D* is the member *F* in which the shank of holder *A* is confined endwise but is permitted to rotate with the broach, a ball thrust-bearing being provided to minimize friction. Member *F* is held to holder *D* by the slot in pin *H* engaging flats on its shank, the shank being free to float slightly for alignment. In removing the broach from holder *A* it is necessary only to pull out pin *B* until its slot is out of engagement with the flats on the broach shank.

Calipering Gear Segments Discussion

R. G. HEWITT
Huddlesfield, Yorkshire, England

In an article under the title given above (*AM*—Vol. 78, page 580), Matthew Harris describes an ingenious instrument by which gear segments can be calipered, and in the use of which calculations are found to be practically unnecessary.

Having had considerable experience in machining work of this kind, I have found no difficulty in calipering gear segments of the type indicated in Fig. 1 with a vernier caliper.

With the segment mounted on either the faceplate of the lathe or on the table of a vertical boring mill, it is rough turned and then bored to size. In finish turning, the dimension *A* can be ob-

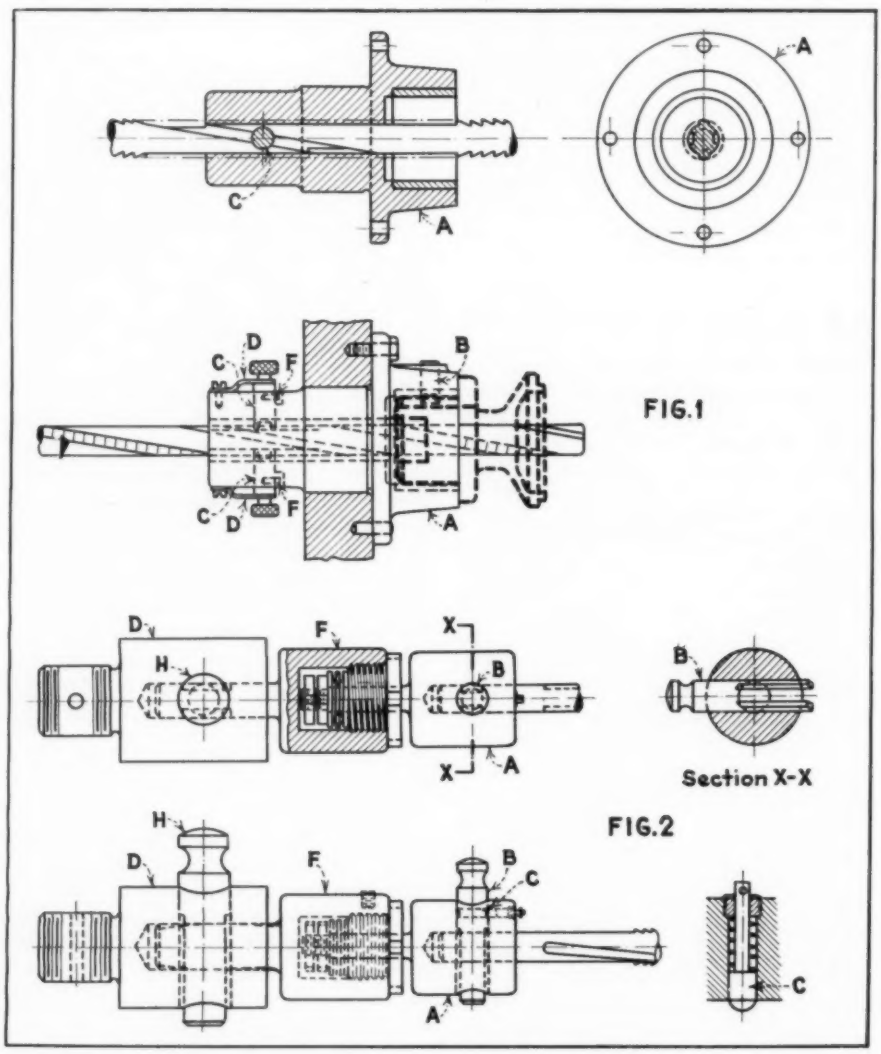


Fig. 1—The broach is caused to rotate as it is pulled through the work by the flatted ends of pins engaging helical grooves in its body
Fig. 2—Interposed between the broach holder and the connection to the drawbar is a member provided with a ball thrust-bearing to permit the broach and its holder to rotate

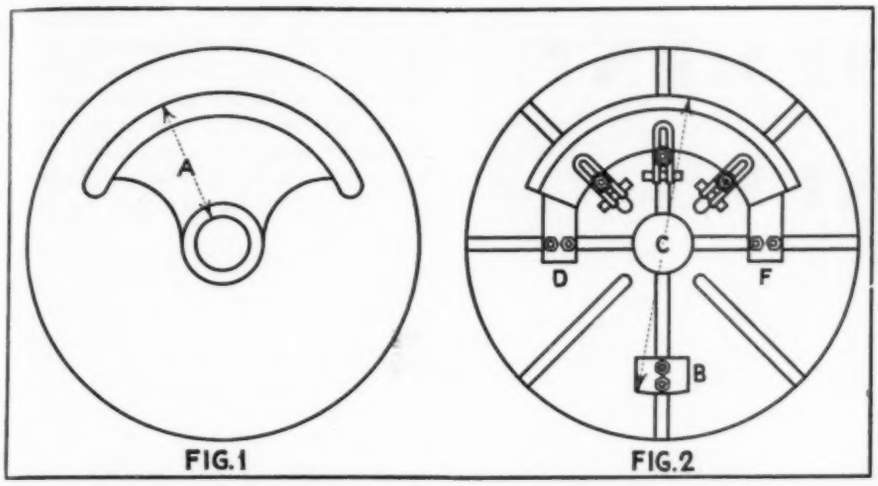


Fig. 1—The radius of the segment is the dimension *A* plus one-half of the bore diameter. Fig. 2—With a cut taken over the segment and the block *B*, the dimension *C* is twice the radius of the segment

tained by deducting one-half of the bore diameter from the radius.

If, however, the segment is of the shape indicated in Fig. 2, a different procedure is necessary. With the segment clamped in position, the cast-iron block *B* is attached to the faceplate opposite to the center of the segment. In the turning operation, metal is removed from the block as well as from the segment. Consequently, the dimension *C* will be twice the radius of the segment and can be easily calipered with ordinary tools.

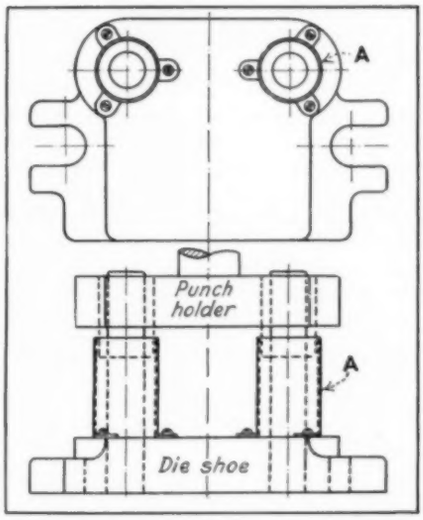
When a quantity of like segments are to be turned, blocks *D* and *F* are clamped to the faceplate and serve to prevent the segment from shifting under pressure of the cut and also as guides for locating other segments approximately. If the segments are less than 180 deg. of arc, two of them can be clamped opposite each other, one segment taking the place of block *B* for calipering.

Leader-Pin Guards

OSCAR BRAST
Tool Designer, Armstrong Machine Works

In die-sets where an air jet is used to blow the work from the die, small cuttings sometimes happen to stick to the oil on the leader pins. If the cuttings stick in one of the oil grooves, the guide pin may be cut.

The accompanying sketch shows guards for the guide pins of a standard die-set. The guards *A* are pieces of thin tubing slightly larger in inside diameter than the outside diameter of the guide bushings and have three ears at the bottom by which they are attached to the die-shoe. The height of the guards should be about ¼ in. less than the distance from the die-shoe to the punch-holder when the tools are at the shut height.

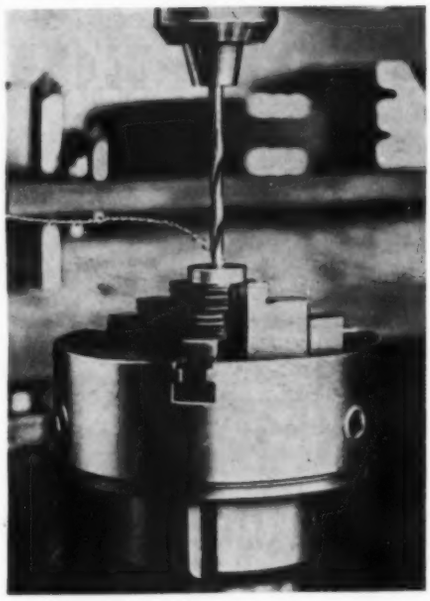


Where parts are blown from a die by an air jet, guards on the leader pins prevent cuttings from sticking to the oil on the pins and causing damage

Lathe Chuck for Holding Work in the Drill Press

MALCOLM K. PARKHURST

A lathe chuck laid face up on the drill press table, as shown in the illustration, makes the handiest sort of vise for holding short pieces of bar stock for drilling axial holes. Any old chuck that has lost its usefulness as a lathe chuck is as good as a new one for the purpose, the sole requirement being that the gripping faces of the jaws must be at right angle to the face.



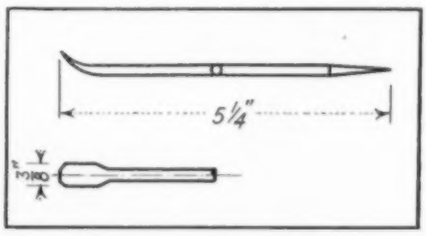
A lathe chuck laid face up on the drill press table makes an ideal vise for holding short pieces of bar stock

Since the chuck holds the work centrally and the base has a comparatively large area, the work is much better supported than if clamped in a V-block. A three-jaw chuck will hold either round or hexagon stock, while a four-jaw chuck can be used for round, square or rectangular stock.

A Thumbtack Lifter

C. F. FITZ

Besides being a real convenience for the draftsman, the thumbtack lifter illustrated will save his finger nails. It is made from $\frac{3}{16}$-in. drill rod and is hardened and tempered. The end for lifting the tacks is flattened and curved as shown. The other end is pointed and is stoned to a sharp needle point. It can be used as a pricker to locate certain points on the drawing.



One end is flattened for lifting thumbtacks. The other end is pointed and can be used to prick location points on the drawing

SHOP EQUIPMENT NEWS

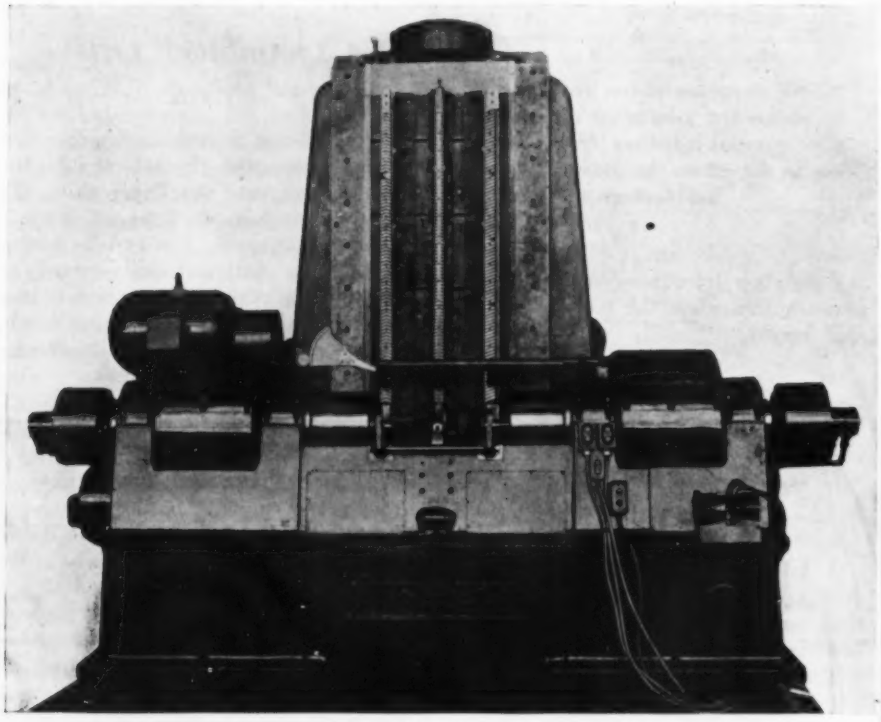
Wickes Broaching Lathe

Wickes Bros., Saginaw, Mich., have developed a "broaching lathe" in which the part being machined is revolved on its axis during the broaching operation. Furthermore, facing cuts are taken as well. The accompanying illustration shows a machine that was developed for rough and finished turning, filleting, facing and shouldering the external cylindrical surfaces of various machine parts. The part illustrated in the machine is a cast alloy crankshaft, and the operations consist of turning, filleting and facing the three main bearings and the pulley diameter adjacent to the front bearing. The broaches are arranged for both roughing and finishing operations. Broaches are designed to provide free cutting at all times and to carry the chips away from the fillets and shoulders.

It is said that with the broaching lathe high production and long life of the broaches are obtained. In the case of the machine shown approximately 2½ times the number of crankshafts per hour can be obtained as from the most modern double-end drive lathe using the conventional high-speed cutting tools. One reason for the high production is the small amount of time required for tool changes, because the wear on the broaches is almost negligible. These broaches will produce from 50 to 100 times the number of pieces per grind that can be obtained with high-speed tool bits. A broach has been used in production for over a year in broaching the center bearing of a crankshaft from the rough and the production obtained is 5,000 to 8,000 forged cranks for each sharpening.

The broaching lathe is equipped with hydraulic chucks and is semi-automatic in operation. After the operator pushes the starter button the machine goes through the rough and finish broaching operations, stops automatically in the unloading position and automatically unloads the crankshaft from the hydraulic chucks. Then the slide which carries the broaches returns to the starting position and stops. Feed to the broach slide is by means of a large-diameter screw and a heavy bronze nut adjustable for wear.

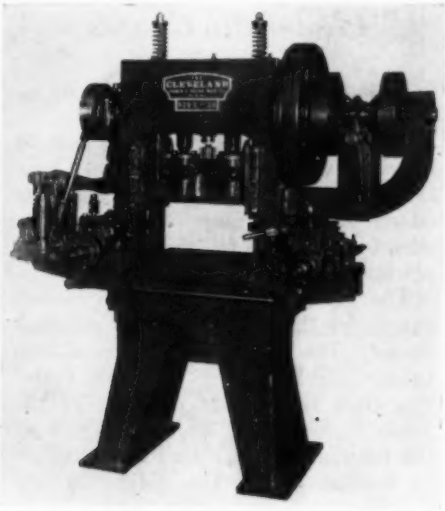
Anti-friction bearings are used throughout the machine, including the main spindles. Double-end drive is used with herringbone gears mounted on the main spindles. A 20-hp. motor furnishes the main drive and a 10 hp. motor the drive for the feed to the broach slide. A 2½-hp. motor is used for the hydraulic pump that actuates the hydraulic chucks and the hydraulic steady-rest. Total weight of the machine including motors and electrical control is approximately 41,000 lb.



In the Wickes Bros. "Broaching" Lathe the part is rotated on its axis, and cylindrical as well as flat surfaces are machined

Cleveland High-Speed Double-Eccentric Press

The Cleveland Punch & Shear Works Co., Cleveland, Ohio, is building a line of high-speed, double-eccentric, all-welded steel frame presses. The model shown can be operated at speeds to 250 r.p.m. It is equipped with a double-roll feed and scrap cutter. The press is



arranged for V-belt drive and has a friction clutch and brake. The slide is provided with adjustment for use when setting dies.

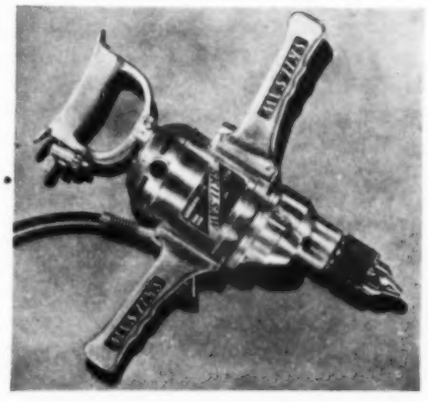
"Whitney" Hand Milling Machine

A hand milling machine, known as the "Whitney," has been introduced by W. H. Nichols, Waltham, Mass. The machine is designed to take care of small-part milling. Power drive is obtained by a ¾-hp. motor which can be furnished for all usual voltages in either alternating or direct current. Drive to the spindle is through a double V-belt which is not only adjustable for tension, but also maintained in constant tension regardless of the position of the head.

The machine has a longitudinal feed of 10 in.; traverse feed, 7 in.; vertical feed, 13½ in. Spindle speeds of 100, 200, 650, and 1,200 r.p.m. are obtained by means of interchangeable double-ratio sheaves. The working surface is 4¼x21 in. Weight of machine is 1,000 lb.

Skilsaw ⅝-In. Standard Drill

The ⅝-in. standard drill offered by the Skilsaw, Inc., 3310 Elston Ave., Chicago, Ill., has a universal motor in which the armature is statically and dynamically balanced, to eliminate vibration. The drill is housed in a die-cast aluminum-alloy body. Ball bearings are used throughout the motor, spindle and gear mountings. Free speed is 500 r.p.m. and weight of the machine is 15 lb.

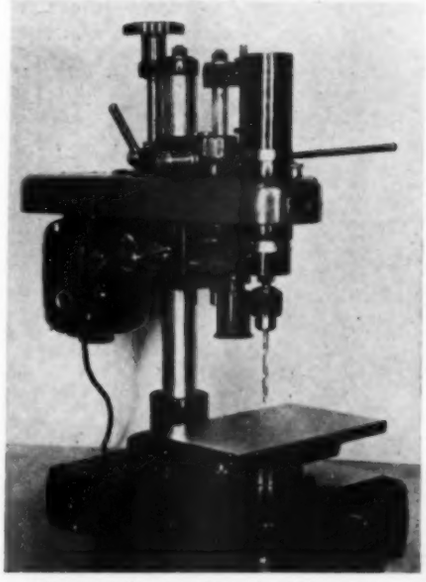


"Maxi-Jr." Sensitive Drilling Machine

Adolph Muehlmatt, Lion Bldg., S.E. Cor. Fifth and Elm Sts., Cincinnati, Ohio, is now marketing the "Maxi-Jr." sensitive drilling machine, with drilling capacity of 0.010 to ¼ in. Four standard drives are obtainable, any one of these drives permitting four spindle speeds. Total speed range covered by these four drives is from 750 to 8,750 r.p.m. Horizontal work capacity of the "Maxi-Jr." is 10 in.; vertical work capacity is 10 in.; size over-all, 24 in. deep, 20 in. high, 10 in. wide, and the weight is approximately 120 lb.

This "Maxi-Jr." machine is readily adapted to group set-up. The base pad is provided with a socket 1¼ in. in diameter. A threaded plug, fitted into the base pad socket, receives a round table 5½ in. in diameter, and a 6x10 in. rectangular table is fitted over the round table. When a group set-up is made a stringer is inserted in the milled slots at the sides of the base pads, and then the stringers and base pads will present a continuous surface to slide the work from spindle to spindle. Thus, any number of machines can be ganged. The rectangular tables can also be made to present an uninterrupted surface when placed side by side.

A 2½-in. vertical travel of the chuck spindle is obtained through a 14-position universal ratchet. The 2½-in. feed of the chuck spindle is controlled by adjustable stops. A ⅛-hp. vertical ball bearing motor furnishes drive.

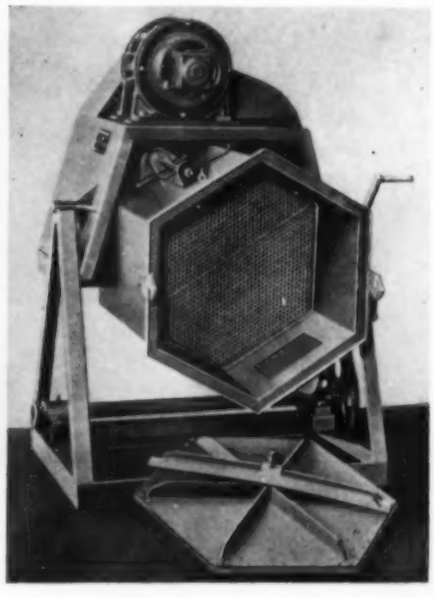


"Maxi-Jr." Sensitive Drilling Machine fitted with a built-in lamp for rapid spotting and drilling of small holes

Ideal Burnishing Barrel

N. Ranschoff, Inc., Cincinnati, Ohio, is offering a small burnishing barrel that makes available to the operator who handles only small batches the economies effected by the automatic transfer of burnishing balls. The barrel may be charged with large work by removing the barrel head which is held in place by a single central screw. Small work is loaded through the small door. The hexagonal burnishing compartment is 12 in. deep, the hexagon measuring 24 in. side to side. The ball compartment is behind the perforated brass plate shown.

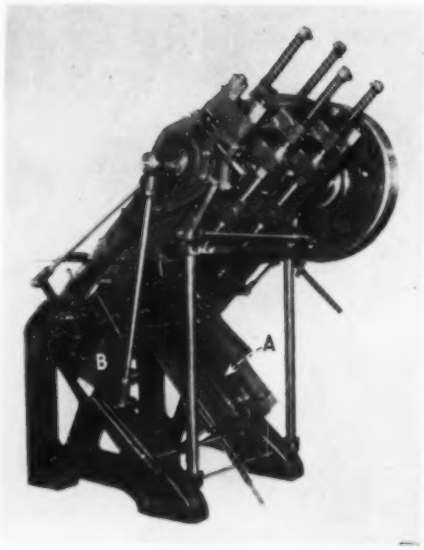
When the barrel is loaded it is tilted 5 deg. below horizontal, and is rotated in the burnishing direction. This causes the balls from the compartment in the rear to move to the burnishing section. When burnishing is completed a turn of the crank tilts the barrel to 10 deg. or 15 deg. above horizontal and rotation is reversed. This causes the balls



to sift out of the work through the perforated plate, and the patented head returns them to the ball compartment. Cupped work is separated from the balls in from 5 to 7 min. A hollow shaft permits the work and balls to be rinsed in the barrel during rotation. Lining may be either wood or ¼ in. abrasion-resisting rubber.

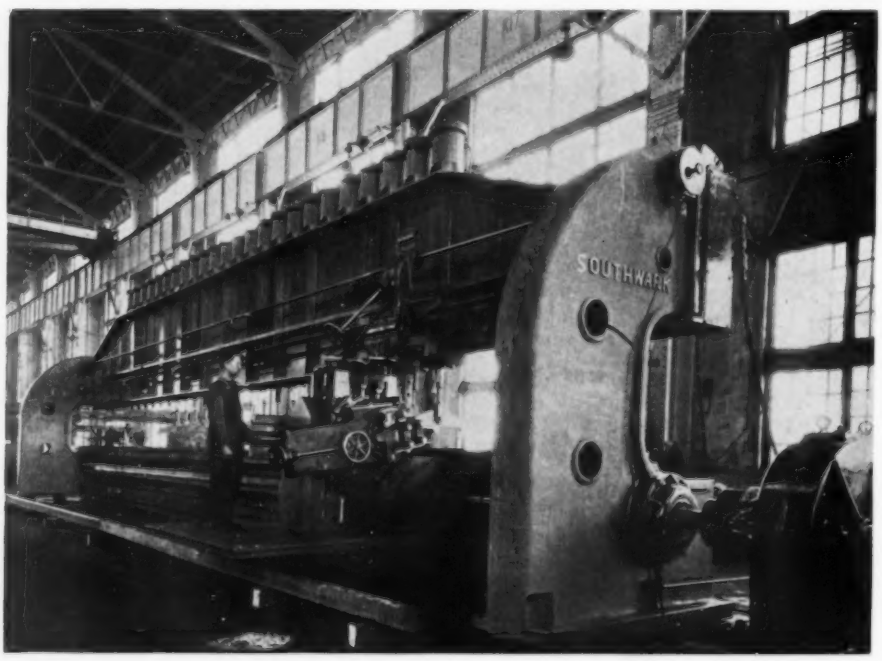
Callahan No. 49 Double-Acting 16-Die Press

A fully automatic, double-acting, multiple-die press has been developed by the Callahan Can Machine Co., Inc., 80 Richards St., Brooklyn, N. Y. The No. 49 machine is equipped with 16 dies and produces 1520 bottle caps or similar articles per minute, or 729,600 in an 8-hr. day. The operator places a batch of tin plate, usually lithographed, in the magazine at *A*. Then one sheet is fed automatically at a time to the dies. The finished work is ejected through chutes, one of which is shown at *B*. Safety devices prevent the feeding of more than one sheet at a time to the dies.



Southwark Heavy-Duty Plate Planer

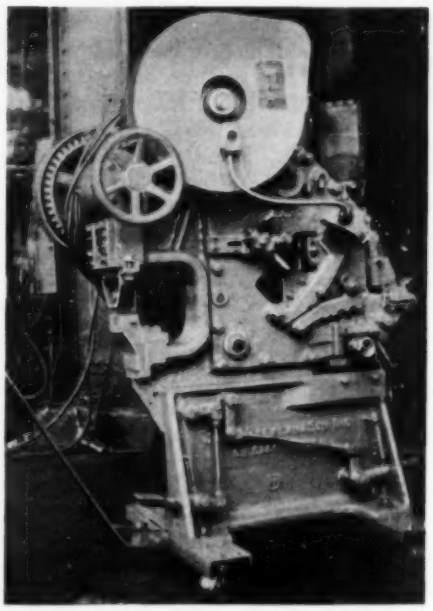
The Southwark Division of the Baldwin-Southwark Corp., Philadelphia, Pa., has completed a plate planer arranged to handle the heavier plate with a deeper scarf than usual. This machine will plane a plate edge 36 ft. long by 4.7 in. thick and will make an 18 in. scarf- or slope, on the edge. The cutting speed is variable from 15 to 45 ft. per min., and cuts are made in both directions of travel of the toolholder. Tool feed is from 1/128 in. to 1 in. per cut. Maximum vertical adjustment of the tool is 10½ in. and the maximum horizontal adjustment is 24 in. The drive screw is 7 in. in diameter by 58 ft. long, and has a quintuple thread. This screw runs in roller bearings. Pneumatically operated hold-downs grip and clamp the plate with a load of 120 tons. A 50-hp. motor drives the machine. All controls are operated from the tool carriage on which the operator rides from end to end of the plate.



Ryerson Portable Combination Shear, Punch and Coper

Joseph T. Ryerson & Son, Inc., 16th and Rockwell St., Chicago, Ill., is marketing a combination shear, punch and coper of portable design. This machine has all of the standard features of the cast-steel combination machines on the market for several years. A ball-bearing caster and steel channel mounting has been arranged so that the machine can be pulled anywhere about the shop.

A 50-ft. extension cable provides electrical connection to most any location.

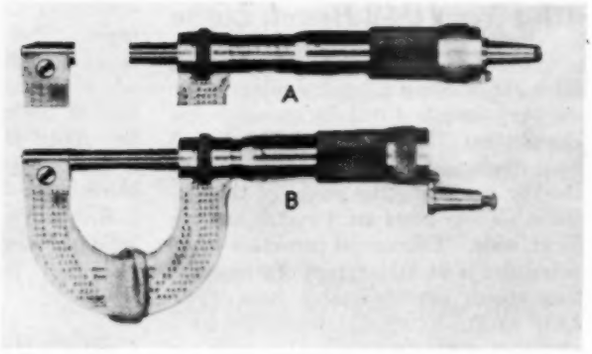


The handle for pulling the machine can be connected at either end so that it is not necessary to turn the machine completely around to run it in the opposite direction.

The frame of this machine is a one-piece, alloy-steel casting. Punching, plate and bar shearing, angle and tee cutting, angle mitering, coping and notching are the operations that can be done. The machine can be furnished in various sizes.

Costello Quick-Acting Micrometer Attachment

The quick-acting micrometer attachment is obtainable from Henry O. Costello, 91 Raymond St., Providence, R. I. It is a sleeve adapted to be fitted over the knurled end of any standard micrometer, plain or ratchet type, for the purpose of securing quick rough adjustments. The attachment comprises a pivoted arm and combined operating



Costello Quick-Acting Micrometer Attachment fitted over knurled end of standard micrometer. Crank is shown locked at *A* and in eccentric operating position at *B*.

and locking pin. The arm may be locked with the pin in axial alignment with the sleeve, as in *A*, or turned outwardly and held in eccentric relation with the axis of the micrometer, as in *B*, thus forming a quick-acting crank.

Boston Motorized and Plain Speed Reducers

The Boston Gear Works, Inc., North Quincy, Mass., has developed five motorized speed reducers and one plain speed reducer. Fig. 1 shows a Type MA horizontal reducer having a single reduction, right-angle worm drive. This model may be obtained with a shaft projecting from the side opposite to that shown or from both sides. It is available with either a $\frac{1}{8}$-, $\frac{1}{4}$- or $\frac{1}{3}$-hp. a.c. or d.c. motor. The standard assembly is available in ratios from $3\frac{3}{4}$ to 1 up to 48 to 1. It has torque capacities up to 263 lb.-in., and is designed to run continuously at the rated capacity.

Type CMA motorized speed reducer, shown in Fig. 2, is a horizontal model having a compound-reduction, right-angle gear drive. The shaft may project from the side opposite to that shown, giving two widely different speeds of the driven shaft. It is available with a 1/6-hp. a.c. or d.c. motor and is furnished in ratios up to 5000 to 1. The torque capacities range up to 1500 lb.-in. for continuous operation.

Type VMA, Fig. 3, is a vertical reducer having a single-reduction, right-angle worm drive. It may be obtained with the shaft projecting above the housing or in both directions. The standard assembly is available in ratios from $3\frac{3}{4}$ to 1 up to 48 to 1, and in torque capacities up to 263 lb.-in.

Type CVMA, Fig. 4, is a vertical compound-reduction, right-angle gear drive. The shaft may project above the housing or in both directions, and is supplied with or without a base. It is available with a $\frac{1}{4}$-hp. a.c. or d.c. motor and is available in ratios up to 5000 to 1. The maximum torque capacity is 1500 lb.-in.

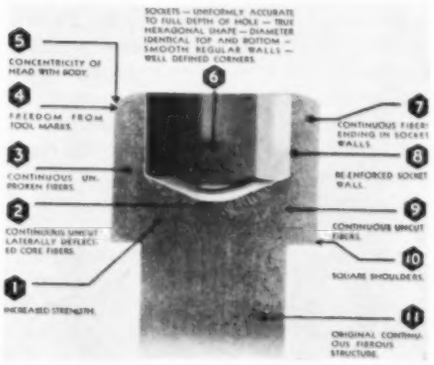
Type IMA, Fig. 5, is an inverted-type reducer having a single-reduction, right-angle gear drive. The shaft may project from the side opposite to that shown or from both sides. Sizes available are 1/6, $\frac{1}{4}$ or 1/3 hp. Ratios range from $3\frac{3}{4}$ to 1 up to 48 to 1. Torque capacities up to 263 lb.-in. are available in Type IMA motorized speed reducers.

Type LD parallel-shaft, plain speed reducer, Fig. 6, is a larger model supplementing two smaller reducers of similar design. The Type LD is available in 20 ratios ranging from $37\frac{1}{2}$ to 1, to 1740 to 1, and has a double-reduction worm drive.

In the various models the worm is of hardened steel, ground and polished and the worm wheels are phosphor bronze. Anti-friction bearings are used in all types. Oil seals are employed to retain the lubricant.

"Fibro Forged Screw" Socket Head Screw

The Holo-Krome Screw Corp., Bristol, Conn., is offering a socket head screw under the trade name "Fibro Forged Screw." The method employed in the manufacture of this screw results in continuous uncut fibers from one end of the screw to the other, as shown by the illustration. Further features are controlled grain size of the steel.



Chicago Chipper's Goggle

The Chicago Eye Shield Co., 2300 Warren Blvd., Chicago, Ill., is introducing the No. 535 chipper's goggle which has individually molded right and left bakelite eye cups to fit any facial contour. The cups are shallower in design than formerly, so that the lenses set closer to the eyes and give a wider range of vision. All metal parts are finished in black to prevent glare and are corrosion proof. An exclusive feature is the baffled vents in the edge of the eye cups under the lens, to give cross circulation of air. Thus, the goggle is claimed not to fog and is comfortable to wear.

"Invincible" Vacuum Cleaner

The Invincible Vacuum Cleaner Manufacturing Co., Dover, Ohio, is producing an industrial-type vacuum cleaner for use in machine and tool shops. The equipment is readily portable. A four-stage turbine exhauster powered by a

1½-hp. motor produces a suction of 52 in., water gage, to pluck up dust, dirt, litter, metal chips and filings at the rate of 155 cu.ft. of air per min. The weight of the machine is 250 lb.

Grand Rapids No. 35 Hydraulic-Feed Surface Grinder

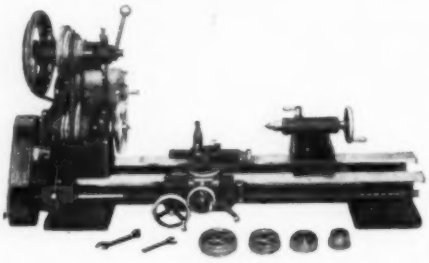
The Gallmeyer & Livingston Co., Grand Rapids, Mich., is manufacturing a hydraulic-feed surface grinder, known as the No. 35. The table has a working surface of 8x24 in. The grinding wheel has an hydraulic longitudinal movement of 26 in., and a transverse movement of 9¼ in. A 10x1 in. wheel is standard equipment.

A large handwheel providing direct action to a worm and worm gears in the elevating mechanism provides rapid adjustment. This handwheel is graduated in one-quarter thousandths with a movable pointer which can be set for convenient readings. A vernier effect on the adjusting mechanism makes it possible to give readings of adjustments in tenths of a thousandth, with the ten-thousandths graduations over ⅛ in. apart.

This machine is a self-contained motor-driven unit, one motor driving the hydraulic mechanism and the second attached to an adjustable bracket for driving the grinding wheel spindle through Tex-ropes. The machine is equipped with a one-shot lubricating system. The net weight is approximately 4,000 lb.

Atlas No. 1042 Bench Lathe

The Atlas Press Co., Kalamazoo, Mich., is building a lathe similar to the one they manufactured for several years, except that the compound V-belt has been replaced by a set of backgears, thereby increasing the power of the machine. These gears are 12-pitch and are ⅞ in. wide. This model permits a 10-in. swing and is 24 in. between centers. Sixteen speeds are obtainable from 28 to 2,075 r.p.m. Automatic, reversible feeds are lever controlled. Change gears are provided for cutting 4 to 72 threads per inch, right or left hand. The machine weighs 210 lb.

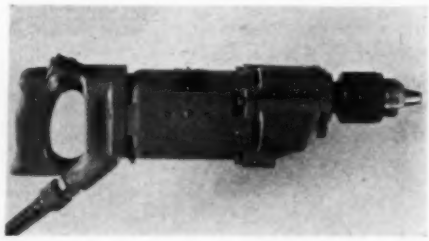


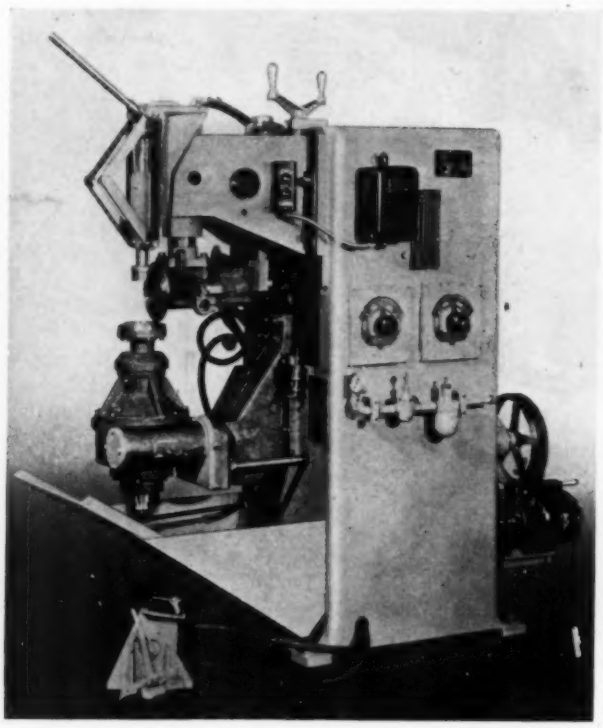
Thomson-Gibb Resistance Welder for Spherical Work

The Thomson-Gibb Electric Welding Co., Lynn, Mass., has furnished the General Electric Company a special seam welder for assembling the compression headers in electric refrigerators. The header is a ball-shaped unit made up of two half spheres, with outwardly turned flanges. Seam welding makes the assembly of these units both simple and rapid. The bottom half of the header is set in place in the lower welding roll which is shaped to hold it. The top half of the sphere is then placed under the upper or idler roll and adjusted by a hand toggle work locator. A special worm drive operates the lower roll and a Reeves Vari-Speed pulley controls the welding speed within a range of 1½ to 4½ ft. per min.

"Hercules" No. 31 High-Frequency Electric Drill

The "Hercules" No. 31 high frequency electric drill, put out by the Buckeye Portable Tool Company, Dayton, Ohio, is a general-purpose tool. It is equipped with a high-frequency motor and is obtainable with side handle and switch, as well as in the spade handle design illustrated. Motor specifications are as follows: 3 phase, 180 cycles, 110 or 225 volts. The drill has the capacity of ⅜-in., and light ½-in. drilling. This drill is 15¼ in. in length and weighs 10½ lb. Other drills of the same type construction as the No. 31 described can also be furnished in various sizes.

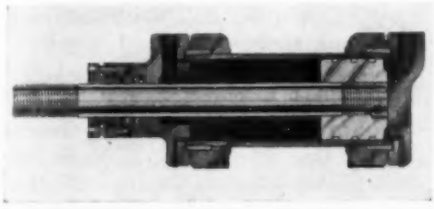




Hannifin Hydraulic Cylinder

A line of double-acting cylinders for high-pressure hydraulic service has been added to its line by the Hannifin Manufacturing Co., 621 South Kolmar Ave., Chicago, Ill. While only one type of mounting is hown, cylinders are available in numerous types and in a wide range of sizes. Practically any length of stroke can be furnished. The standard models are designed for pressures up to 1,500 lb. per sq. in. Special cylinders can be had for higher pressures.

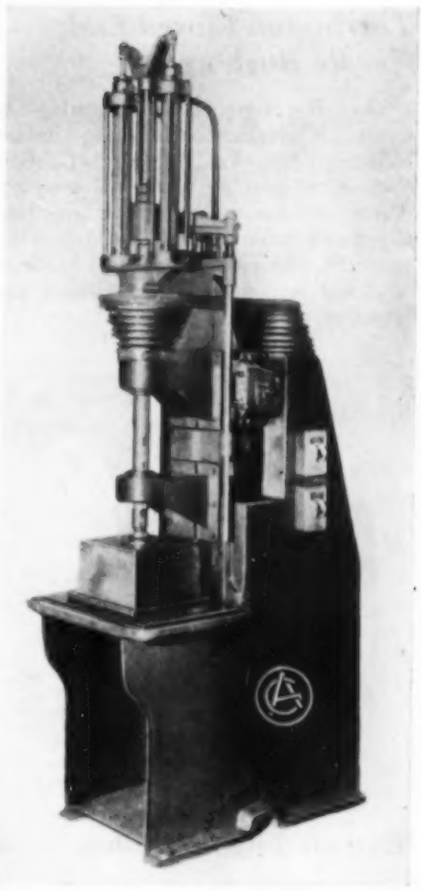
A feature of this cylinder is the fact that tie-rods have been dispensed with, thus enhancing the appearance and further preventing leakage.



Cylinder caps can be removed without disturbing the mounting. Each end cap can be positioned independently of the other, and can be turned so that the inlet port is located at the top, bottom or either side. Air vent plugs are provided on each side of the caps, so there is always an air vent on top.

Giern & Anholtt Carbide Boring Machine

A "Carbideborer" machine has been developed by the Giern & Anholtt Tool Co., Inc., 1312 Mt. Elliott Ave., Detroit, Mich., for utilizing tungsten carbide as a cutting medium. Drive is obtained from a double V-belt. Stroke in the model shown is 18 in. The hydraulic feed varies from 0 to 315 in. per min. and the boring capacity ranges from ¾ to 2½ in. diameter. The spindle pulley runs in ball bearings, and the spindle proper is fed down through the company's rotary bushings, the drive being accomplished by means of a floating key. A No. 4 Morse taper is used in the spindle.



Hydraulic feed of the spindle can be varied from 0 to 315 in. per min. Stroke is 18 in.

Two revolving drums throw the work onto a center strip and under a stream of abrasive. The abrasive is reclaimed

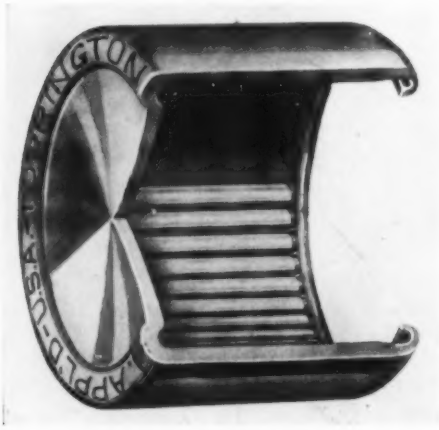
Pangborn Type GI Centrifugal Blast-Cleaning Machine

A Type GI centrifugal blast-cleaning machine, which cleans various sizes and shapes of castings without the use of compressed air, has been developed by the Pangborn Corp., Hagerstown, Md. This machine cleans loads up to 18 cu.ft. in bulk and averaging 2,200 lb. in weight, in times which vary from 7 to 15 min. The interior of the machine has two revolving drums and a stationary "armor plate" strip through the center. The action of the revolving drums throws the castings onto this center strip directly under the abrasive stream created by a revolving wheel. In this manner each casting is cleaned.

The loading door is opened and closed by a quick-acting cylinder. An electric time clock automatically operates a warning signal when cleaning is completed. Abrasive is used over again, being cleaned and handled by a separator and elevator unit built into the machine.

Torrington Closed-End Needle Bushing

The Torrington Co., Torrington, Conn., is now manufacturing needle bushings (*AM*—Vol. 78, page 627), with a closed end, as an additional product. There are some locations where this closed-end bushing has advantages because the one-piece outer shell raceway is closed on one end to facilitate the retention of oil and grease.



Detroit Toggle Clamp

The Detroit Stamping Co., Detroit, Mich., is producing a toggle clamp for the purpose of holding down work to ensure alignment or to permit of the working out of succeeding operations. The principle of the toggle clamp is that the handle and the clamping bar travel on two distinct orbits, the orbit of the handle being about twice the diameter of clamping bar orbit. The speed of the bar and the travel of the handle are in direct relation to the location of the pivot points. Movement of the handle through 80 deg. on the clamp illustrated results in the bar moving through a 160 deg. arc. For 70 per cent of the travel of the handle, the bar travels approximately three times as fast as the handle. From this point on, the handle travels increasingly faster than the bar. At the final 5 deg. of travel the device has a mechanical advantage of 12 to 1. Full clearance of the hold-down point from the work is provided when open, with only a short movement of the handle.

• TRADE • PUBLICATIONS

ARC WELDER. Bulletin GEA-1440C put out by the General Electric Co., Schenectady, N. Y., gives detailed information concerning their Type WD electric welder. The folder is well illustrated and gives sizes and ratings of types of units now available.

AUTOMATIC LATHE. A pamphlet describing the Fay automatic lathe for manufacturing transmission gears and shatfs has been published by the Jones & Lamson Machine Co., Springfield, Vt. Illustrations show various operations as performed by the Fay lathe.

BROACHING MACHINE. The LaPointe Machine Tool Co., Hudson, Mass., in Bulletin No. 75 discusses its duplex variable hydraulic surface broaching machine. A table of specifications is given for the 3-, 6-, and 12-ton sizes.

BORING, DRILLING AND MILLING MACHINES. Detailed illustrations and descriptions of the Series 30 boring, drilling and milling machines are offered in a catalog by the Giddings & Lewis Machine Tool Co., Fond Du Lac, Wis. Included are tabulated specifications and line drawings giving dimensions for standard and oversize machines.

DIAL INDICATORS. In a 24-page booklet, "Dial Indicators," the L. S. Starrett Co., Athol, Mass., presents its latest line of indicators. Eight different types are shown. Various dials are graduated in 0.001, 0.0005, and 0.0001 in. and read either plus or minus. The last few pages illustrate construction details. Special indicators and gages are listed.

GAS BURNERS. Characteristics of the "Refrak Screen" burner are set forth in a bulletin by the Selas Co., Philadelphia, Pa. Specifications and dimensions are included. Graphs show the capacities of burners for various gases and pressures.

MECHANICAL RUBBER GOODS. Practical information about hose, belting, packing, and miscellaneous mechanical rubber products is provided in a catalog by the New York Belting & Packing Co., Passaic, N. J.

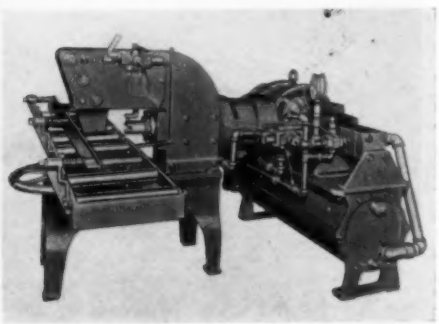
PRESSED SHAPES. A pamphlet has been issued by the By-Products Steel Corp., Coatsville, Pa., illustrating and describing their service and supply of sheared plates, pressed shapes, and steel blanks made to order.

WELDING ELECTRODES. The General Electric Co., Schenectady, N. Y., in Bulletin GEA-1546B lists the applications of fourteen types of welding electrodes and includes illustrations of their various usages. Welding supplies and accessories are discussed.

Hannifin Hydraulic Riveting Machine

The 50-ton hydraulic riveting machine, shown in the illustration, is being used for heading several rows of ¾-in. hot rivets on track frames for crawler-type tractors. It was built by the Hannifin Manufacturing Co., 621 South Kolmar Ave., Chicago, Ill.

The work is advanced between the dies on a roller-bearing equipped conveyor. By means of a vertical adjustment the various rows of rivets are brought into alignment with the dies. The riveting cycle is completed automatically. Maximum working pressure is 1,600 lb. per sq. in. and may be reduced for heading smaller rivets. Ram travel is 5½ in. The press is equipped with a 10-hp., 900-r.p.m. motor.



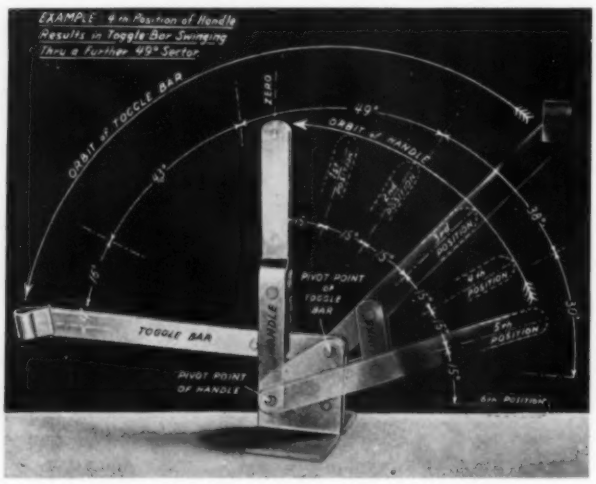


Diagram showing movements of toggle bar when handle is swung thru successive 15 deg. sectors.

THE ROUND TABLE

Shop Instructions

"What's all the paper work, Al?" asked Ed, as Al came into his little office with a pad filled with notes.

"Just checking up on some of the operations on the new compressor rotor, Ed."

"All you need is a stop watch to look like a real time-study guy. Aren't going scientific, are you, Al?"

"Guess not; it depends on definitions perhaps. The fact is, I'm putting information on paper, or cards, that we've been carrying in our heads."

"Sort of a planning department, eh? Going to tell the men just what they must do with both hands and feet, I suppose. Don't your men know how to make the rotors without instruction sheets?"

"Sure they do, Ed. And if I knew we'd always have the same men or that we'd never need to hire more, I wouldn't take time for this. But men do leave for one reason and another, and we hope to need more men on this job next year. I figure it will save time to have these sheets handy in breaking in new men."

"Good men ought to know how, Al. They may even have better ideas than you are now using. Won't these sheets of yours handicap them instead of helping?"

"I don't see how they can, Ed. These are not iron-clad orders but more like suggestions to the new men until they get used to the work."

"Orders are orders, Al. You've either got to make them follow instructions or let them do it their own way. You can't mix them up that way."

"I can't agree with you at all. If I was tackling a new job I'd be glad to have an outline of the way it had been done before. But I'd hate to be told that it must be done that way regardless of any new ideas I might have."

"The average man you hire hasn't any special ideas anyhow, Al. He'd rather be told what to do and not try to find a better way. If you're going to use those operation sheets you might as well issue them as iron-clad orders."

"I'd hate to think that was true, Ed. I'd rather think it was indigestion or just pure cussedness on your part. If you are right, we've got a slim chance to get good foremen for our shop. But even then these instruction sheets will be worth while. And my way won't prevent us getting new ideas if a miracle man comes along."

Is the instruction sheet idea sound in the small shop? Should it be mandatory as Ed suggests, or optional as Al would have it?

Discussion

Rolling Your Own

Before deciding whether tools should be made at home or by an outside shop, quality and cost must be accurately known. Quality comes first, and it is to be assumed that the home shop can make the tools to the required accuracy. In determining whether or not tools of the required quality can be made at home, the stage is set for accurate costing. Many concerns place orders for tools outside because their costing is inaccurate, or because the managers have failed to take into account many factors, such as absorbing overhead and holding good men who will be wanted later.

There is another aspect that concerns the production manager. He may consider from personal experience, but before costing has been established, that it will be wise to reduce his personal load of work by placing orders for tools outside. The opposition to such a step is frequently insurmountable, as the owner is so cocksure that no one can beat what he has been doing for half a century. Many managers have thrown up the sponge because they were not even allowed to demonstrate how their own costs compared with those of other and successful concerns. The ostrich that buries his head is wise when compared to some conservative owners.

M. P. DALTON,
Kent, England.

Al is certainly right in buying his jigs and fixtures from a specialized tool plant. While the use of jig borers is increasing, there are many toolrooms that do not have one, so it is better and cheaper to have holes bored on a jig borer in a special tool plant than it is to "button" the work in the lathe or milling machine.

Press tools of costly steel and complicated design can be quickly ruined by faulty heat-treatment. Hardening by guess should be definitely scrapped by the use of gas or electric furnaces that are controlled to the heat required for every kind of steel. The greater part of the cost of gages is in the method employed in making them. Thread gages can now be ground direct from the hardened blanks on thread grinders. Snap gages can be ground in a few minutes as compared with the

usual and laborious method of filing and lapping.

Jig borers, measuring machines, gages and centerless and thread grinders cost a small fortune, but even the one-man shop can have the advantage of this concentrated accuracy by ordering his tools from a special tool shop.

—W. A. Harris,
Coventry, England.

Chiseling Chisel Prices

As an individualist I do not favor government control of prices. The way to encourage initiative is to establish individual self-government. Prices should not be subject to government regulations or individual whims. The things we eat, drink and wear are produced by human work. They are made from natural resources, which normally are free. Prices should show the amount of human work that the consumer owes the producer. Our present price-fixing system gives no information as to the amount of human work anything contains. Our dollar has no definite purchasing power.

This system cannot be made flexible enough to encourage initiative. With an honest monetary unit there would be no government interference with individual initiative, and prices would be automatically determined by the amount of human work expended in the production of each item priced. "Chiseling" is an inevitable accompaniment of our present price-fixing methods.

—W. E. Brokaw,
Executive Secretary, Equitist League.

The Better Foreman

A foreman ought to be able to show his men just how jobs should be done, and I think that one who is not able to do so is an object of pity. He may bluff or placate his men for a time, but will soon be found out. When piecework problems come up and men complain to him that the time allowances are too small, how is he able to make a consistent report to the rate fixer unless he knows whether or not the jobs are being done in the quickest and best way?

I would advise those men whose aspersions are toward foremanship to seek every possible means, by actual operation and by study, to become acquainted with shop processes—and if they are of the type suitable, by keenness and general adaptability, to fill a foreman's place they will be able to inculcate and absorb the necessary knowledge and expertness in a short time.

The man whom Williams referred to as being the best shop boss he ever knew may have been able to handle his men by "playing the game," but I would be sorry for him when a smart referee asked questions.

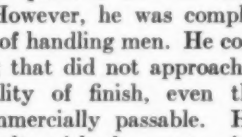
—J. T. Towlson,
London, England.

Skill as a workman is an excellent quality, but to appoint a man to the position of foreman largely because of his superiority in this respect shows ignorance of the qualities best suited to the position. A man who is a born leader might be unable to tackle many of the jobs in the shop, but tact, firmness, good judgment, a knowledge of human nature, and a general idea of shop operations and routine will see him through.

I knew of a man who was one of the finest toolmakers in this country and who knew all the shop kinks. Because of these qualities he was made foreman. However, he was completely incapable of handling men. He condemned all work that did not approach his own for quality of finish, even though it was commercially passable. He found petty faults with the most unimportant details. Work took twice as long as it should. Labor turnover trebled, and the better class of mechanics refused to work under him.

Eventually his department was closed because it was unremunerative, but the consensus of opinion of disinterested observers was that the foreman was to blame. Of course, the manager who put him there was equally at fault, but it illustrates how much more important are other qualities than mere skill.

—Roy Vernon Wade,
Glasgow, Scotland.



No matter what position a man occupies, a knowledge of the work and the processes carried on around him are of value. However, a foreman need not be capable of actually doing a job himself, and it may be found that years of service as a foreman rob a skilled mechanic of his manual dexterity.

The essential characteristic of a foreman is his ability to manage. He must be able to control his men, see that they carry out his orders and work at a reasonable pace. He must be able to plan and organize in order that work shall pass through the shop smoothly and rapidly.

The foreman should possess sufficient knowledge of all the processes involved to be able to offer suggestions for carrying out the work, should the need for this ever arise, and he should know enough to be able to distinguish between good and bad methods. But there is a difference between a sound general knowledge and the ability to carry out all the processes to perfection.

—R. Hutcheson,
Kenton, Middlesex, England.

Profit Motive

Is the profit motive threatened? Surely, but then it has always been threatened, at least for many people. Even in boom times there were some concerns that were unable to operate profitably. Some executives show poor judgment in not buying equipment that is best suited to their needs. Others try to get by with obsolete equipment, and they automatically go on the rocks.

The concern that cannot make a profit usually has an alibi of some sort tending to show that it is through no fault of the management. The regulatory measures now imposed by the government are the most convenient alibis to be found, and it is small wonder that we hear so much about the profit motive being threatened. Nevertheless, it will stand us well in hand to remember that the present course of action is the byduct of an economic emergency, and to maintain a close check in order that industry may remain free.

—John E. Hyler.

Hourly Pay vs. Piece Work

Compensation by hourly pay, piecework, or bonus is strictly a function of the individual plant. In the case of most mass-production operations, the machine is the controlling factor, and there is no particular advantage in the piecework system. In plants where machine output is directly proportionate to the efforts of the operators, paying by the piece is the general practice.

Probably the most effective means of compensation is through composite hourly rates and group bonus. In this case, the efforts of all are definitely coordinated, because of the insistence of group members that each should do his share of work. The real test for any system of compensation is which one will produce the greatest profit for the investment. Personally, I feel that careful planning of operations and adequate tooling, supplemented by specific instruction, will do more to reduce costs than will any other factors.

—Harold L. Wynn,
Executive Engineer,
Pacific Electric Mfg. Corporation.

American Machinist

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Coming

• Next number starts Volume 79 of *American Machinist*, and in it will appear an authoritative article on depreciation reserves by James A. Moffett, Federal Housing Administrator. As evidenced by recent rulings on corporation income taxes, the government is taking a highly realistic viewpoint on this subject. Actual expenditures on replacements are considered a better basis for deductions than charges to "reserves" which are little more than bookkeeping entries.

• Supplementing the Navy story in this number and the previous account of Army arsenals, the Air Corps modernization program will be outlined. This material has been contributed by Major General Benjamin D. Foulois, Chief of the Air Corps.

Volume 78 Number 26

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"No doubt as to which is the first publication . . . *American Machinist*"

ADVERTISERS frequently make tests in metal-working plants to find out which paper carries most weight with their customers and prospects. Below are the results of two typical tests made by well-known advertisers to satisfy themselves on this point.

Test No. 1 . . .

by a large manufacturer of gears and speed reducers

"When all the replies were tabulated, we found 70 for American Machinist, 50 for the second publication, and the rest were either divided between the two or mentioned some other paper."

Test No. 2 . . .

made by the advertising agency of a gear manufacturer

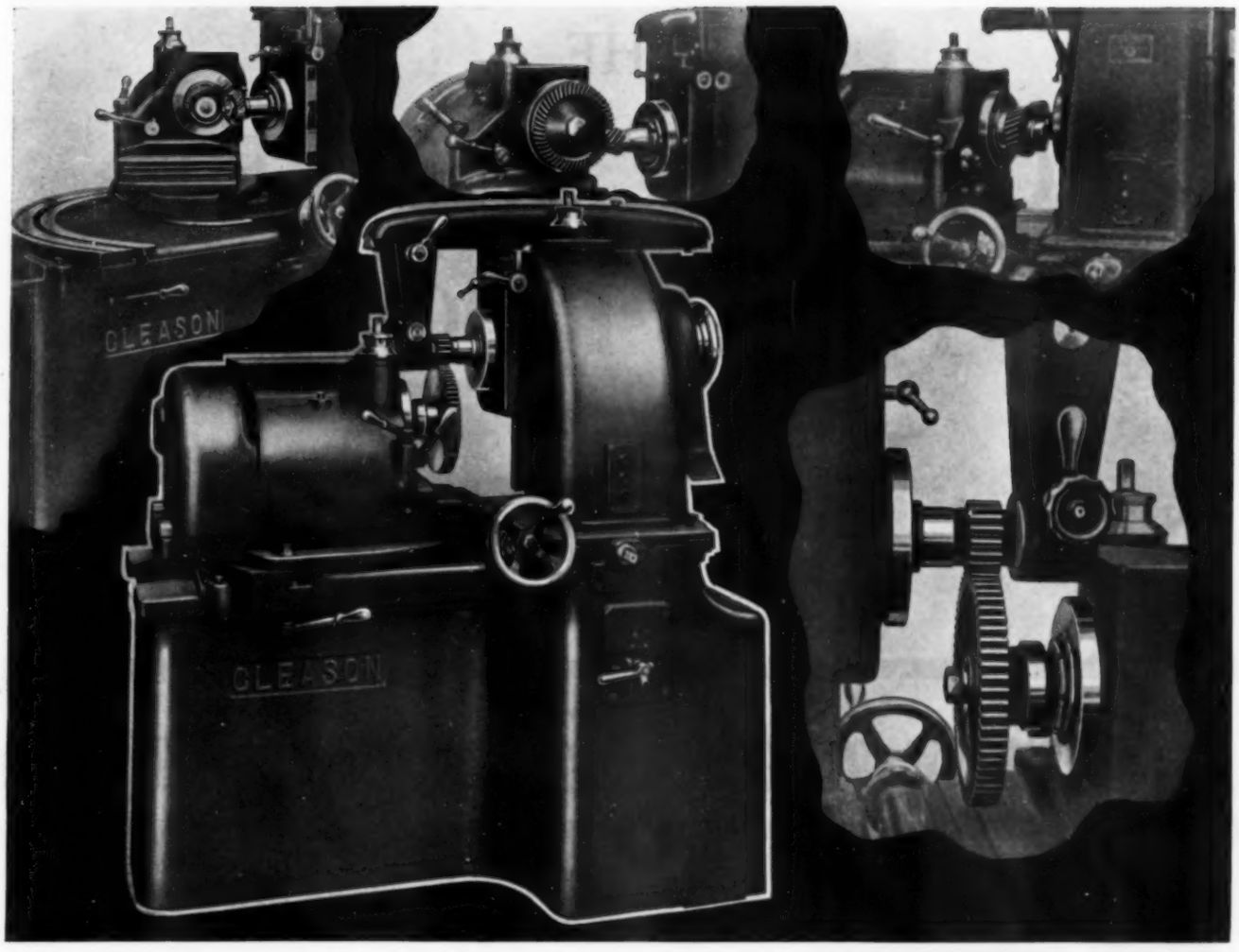
"113 replies were received and you will be interested in the results tabulated below:

American Machinist read by 105 out of 113, or 93%
Second publication read by 67 out of 113, or 59%

To my mind, this leaves no doubt as to which is the first publication."

When production executives vote, American Machinist is preferred . . . . which explains why American Machinist has the largest paid circulation in the metal-working industry.

Many thousand more men PAY to read American Machinist



How do YOU TEST *your gears?*

Straight and Spiral Bevels with any shaft angle ' ' ' Hypoids with offset shafts above or below center ' ' ' Spur Gears ' ' ' Helicals ' ' ' Angular Helicals ' ' ' Internal ' ' ' Herringbone ' ' ' All can be tested on the NO. 13 UNIVERSAL GEAR TESTING MACHINE.

The method of inspection that more nearly duplicates the conditions under which a pair of gears are to finally operate is, in the final analysis, the best form of inspection. By using this machine you can test your gears on their correct centers under a brake load and at their normal operating speeds.

Observe the large and massive frame ' ' ' the overhead tie and outboard support ' ' ' the concealment of all electrical equipment ' ' ' the large hardened and ground work holding spindles which are mounted on anti-friction bearings ' ' ' the wide sliding base supporting the swinging work head.

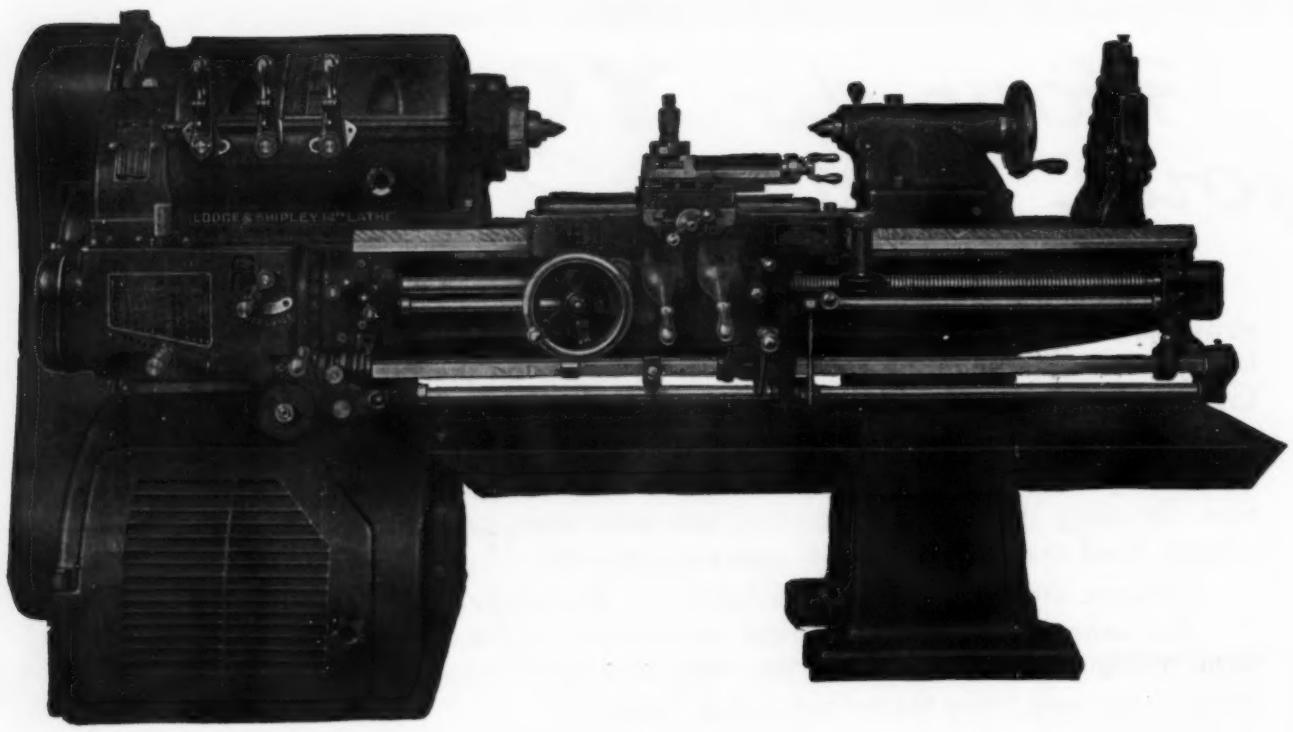
Accommodates Spur Gears up to 14" diameter.

GLEASON WORKS
ROCHESTER, N. Y., U. S. A.

SINCE 1875 GLEASON HAS CONTINUOUSLY CONCENTRATED ON BEVEL GEAR MACHINERY

THE
LODGE & SHIPLEY
TOOL ROOM
LATHE

Accurate Construction



n=Accurate Performance

Precise methods of manufacture are responsible to a large degree for the accurate work of which this Tool Room Lathe is capable.

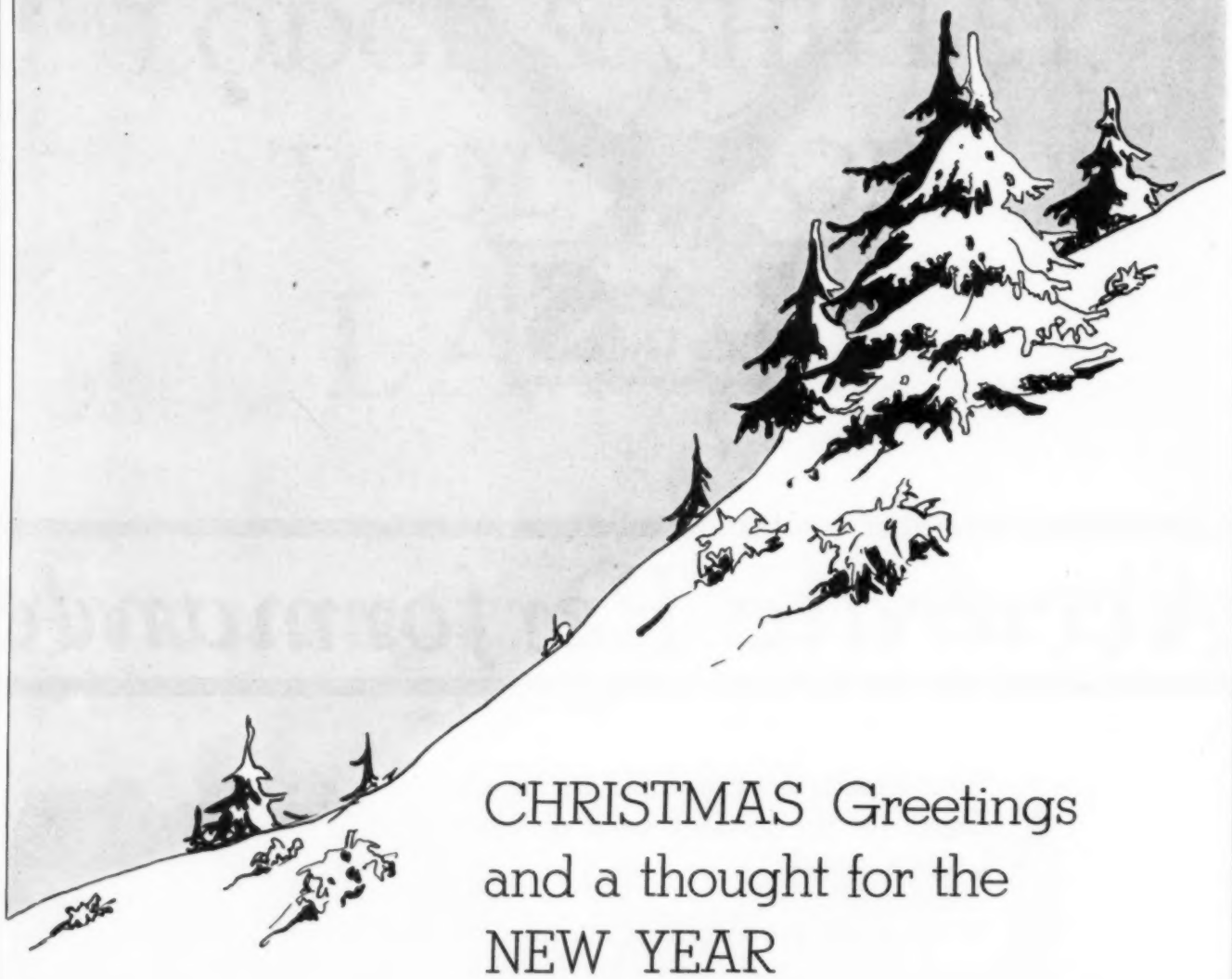
In the construction of this machine, all parts are held to unusually close tolerances. For example, a headstock transmission can be *accurately* placed in any casting of that size with no additional fitting. Interchangeability is the strongest argument that can be made for accuracy.

A lathe is capable of producing work only as accurate as the parts comprising the lathe itself. Lodge & Shipley methods of manufacture have built-in a capacity for accuracy that is gaining for this machine a wide tool room acceptance.

The LODGE & SHIPLEY

MACHINE TOOL COMPANY

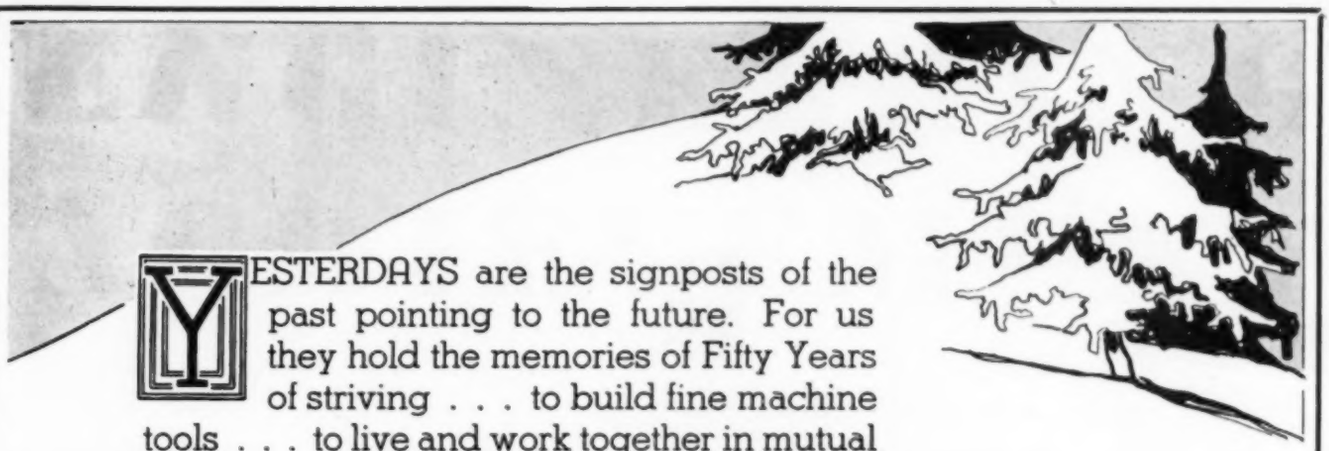
CINCINNATI, OHIO, U. S. A.



CHRISTMAS Greetings
and a thought for the
NEW YEAR
with its many
TOMORROWS

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI GRINDERS INCORPORATED
CINCINNATI, OHIO, U. S. A.

CINCINNATI



YESTERDAYS are the signposts of the past pointing to the future. For us they hold the memories of Fifty Years of striving . . . to build fine machine tools . . . to live and work together in mutual loyalty . . . to be worthy of the good will of our customers . . . to uphold a good name. For us they point the onward path.

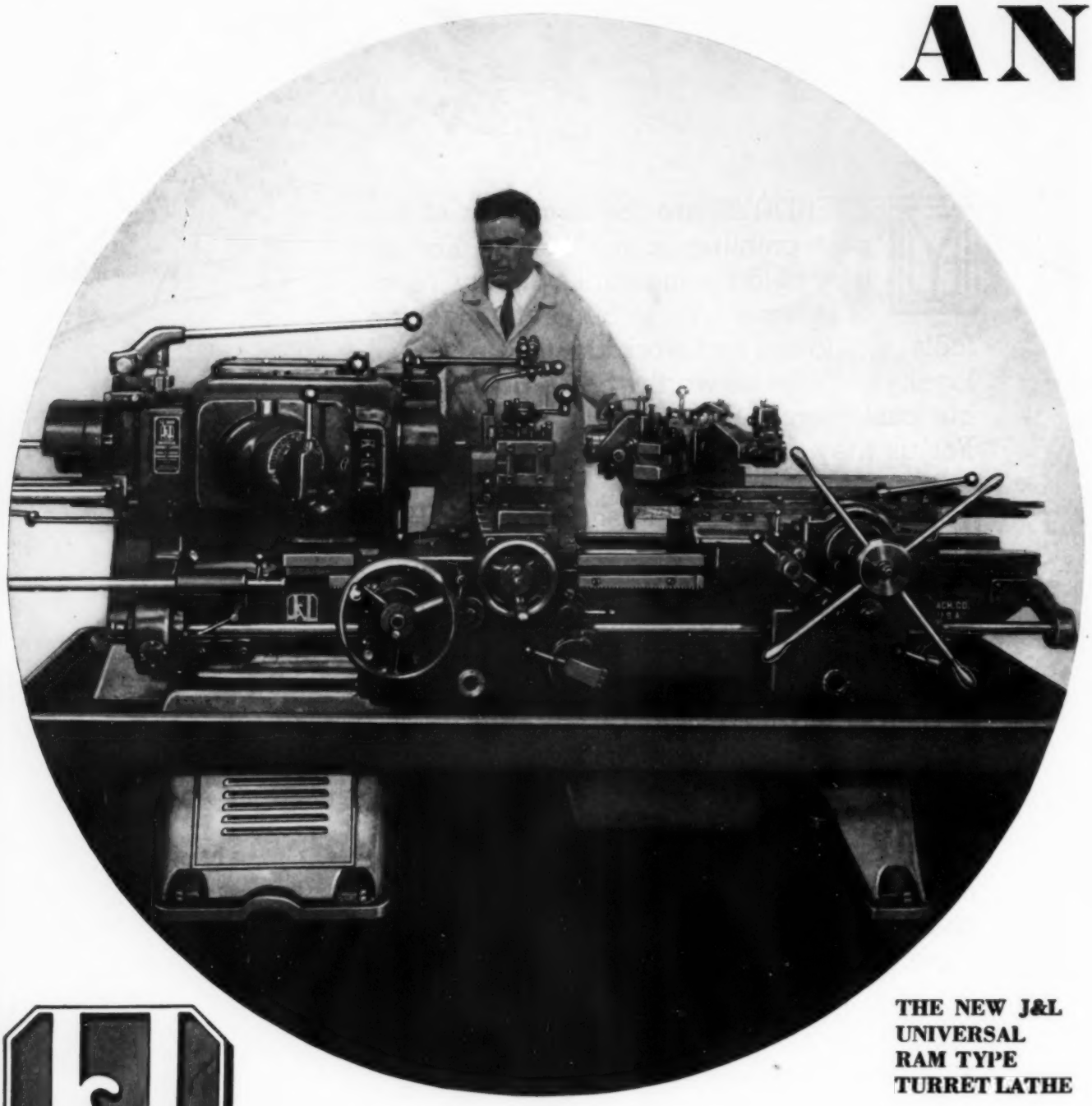
TODAY, at the threshold of the New Year we face forward, confident that the productive operation of American Industry will bring increasing and widespread well-being to our nation.

TOMORROW will be wrought of the experience, the efforts and the vision of yesterday and today. In this tomorrow, Industry must stride forward with the help of machinery and methods, the best of man's contriving. This is a real challenge and the equipment industries will meet it. We stand ready to do our part.

Frederick V. Geier

PRESIDENT

AN



THE NEW J&L
UNIVERSAL
RAM TYPE
TURRET LATHE

This machine is rigidly constructed to stand up under the requirements of the most modern cutting tools with speed, power and stability to spare for future developments in this field.

Its design includes many unique features that make for a great saving in time and fatigue.

It is a joy to the operator. Its simplicity and ease of operation enable him to do a good day's work with little tax on his energy.

The skilled mechanic will see at once that this machine represents an advance in design in all those details which make for production and accuracy, ease of operation and durability of mechanism.

ENGINEERING ACHIEVEMENT

The principle of single lever control is followed throughout the design of the machine—

One lever for all speeds.

One lever for all feeds.

One lever for start, stop and reverse.

One lever controls bar feed and collet chuck.

It has built-in wiring and push button control.

Quick indexing for square turret.

Wide range of spindle speeds with a high speed series for carbide tools.

Automatic brake when lever is thrown to neutral.

Feed accurately disengaged against a positive stop.

Automatic turret clamp.

Multiple stops on carriage cross slide.

Automatic Lubrication.

Headstock gears ground in the tooth-form.

Spindle and shafts mounted on anti-friction bearings.

Widely spaced steel ways, carburized, hardened and precision ground.

Visual oil gages.

Coolant through turret center-pin, automatic with indexing of turret.

JONES & LAMSON MACHINE CO.

Springfield, Vermont, U. S. A.

Now!

"ORIGINAL FELLOWS"

is etched on every cutter for your protection. . . . Look for it. . . . None genuine without that marking. . . .

The Fellows Line includes:—Four distinct types of GEAR SHAPERS; a complete line of GEAR SHAPER CUTTERS; two types of THREAD GENERATORS; HELICAL CUTTER SHARPENING MACHINE; RED LINER; GEAR MEASURING MACHINE; GEAR and WORM LAPPING MACHINES; GEAR LAPS; BURNISHING and MASTER GEARS; etc.

...Your Dollar Buys More...

in ORIGINAL FELLOWS Gear Shaper CUTTERS

CONTINUOUS improvements in the quality and accuracy of ORIGINAL FELLOWS GEAR SHAPER CUTTERS now assure you more gears per grind and more gears per cutter . . . . lower cutter costs per gear and fewer rejects. . . .

Any small difference in initial cutter cost is insignificant in the face of possible rejects, tear-downs, wasted material and machining time, not to mention the tying up of costly equipment.

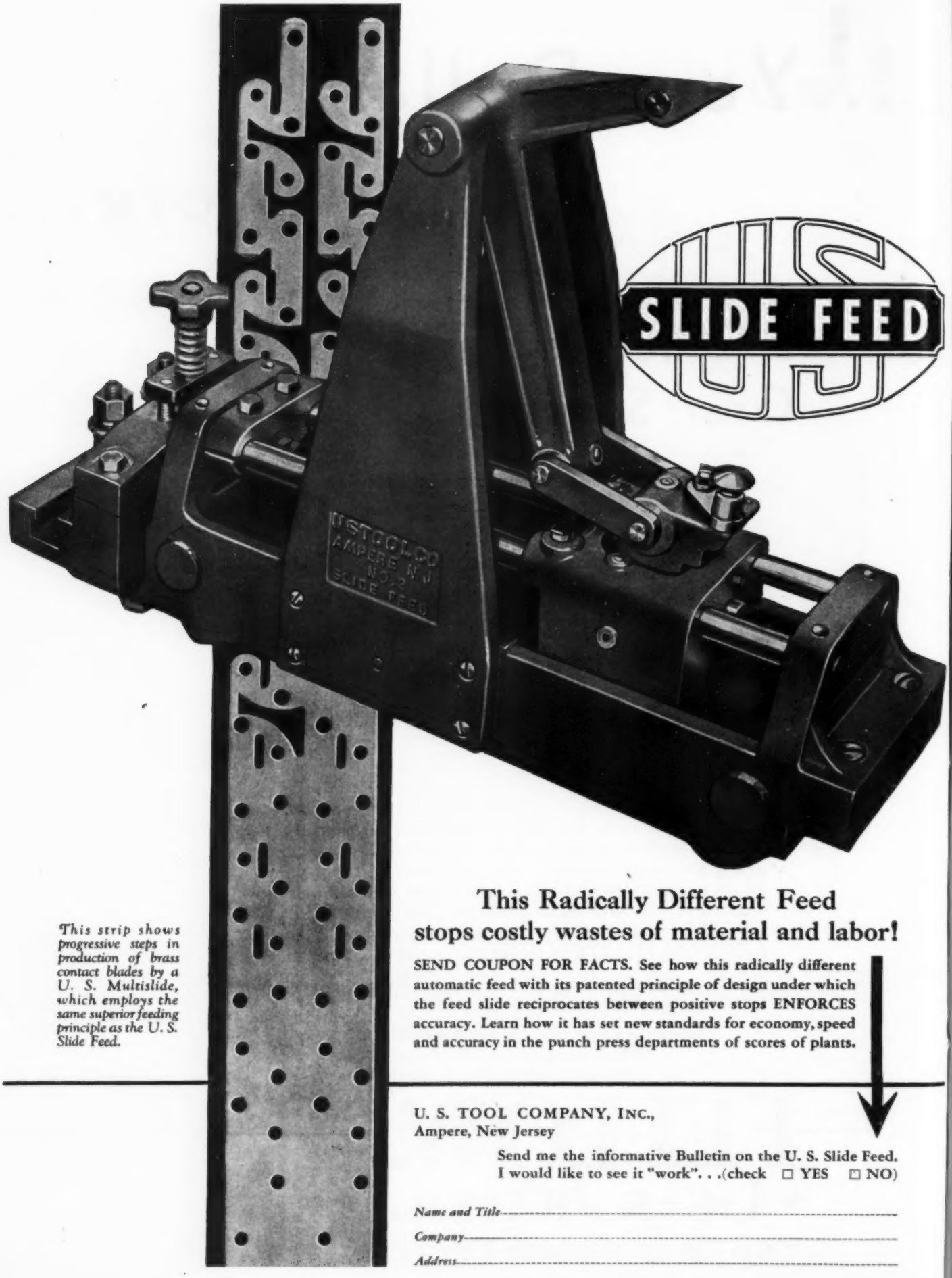
ORIGINAL FELLOWS GEAR SHAPER CUTTERS are not made to "sell at a price," but to produce satisfactory gears. It is also to your advantage that there should be no divided responsibility as between the Gear Shaper and the Cutter used on it. As makers of the Gear Shaper and Gear Shaper Cutter, we know that where high accuracy is demanded, complete control is absolutely essential. The only kind of cutter you can afford to buy is one which produces gears that will pass close inspection. To have implicit faith in ORIGINAL FELLOWS CUTTERS is the sure way to avoid gear troubles. Insist on ORIGINAL FELLOWS CUTTERS for use on your Gear Shapers.

A new circular covering Standard Spur Gear Shaper Cutters has just been printed; for your copy write:—

THE FELLOWS GEAR SHAPER COMPANY,
78 River Street, Springfield, Vermont—or
616 Fisher Building, Detroit, Michigan.

FELLOWS
GEAR SHAPERS
AND GEAR SHAPER CUTTERS

718



This strip shows progressive steps in production of brass contact blades by a U. S. Multislide, which employs the same superior feeding principle as the U. S. Slide Feed.

This Radically Different Feed stops costly wastes of material and labor!

SEND COUPON FOR FACTS. See how this radically different automatic feed with its patented principle of design under which the feed slide reciprocates between positive stops ENFORCES accuracy. Learn how it has set new standards for economy, speed and accuracy in the punch press departments of scores of plants.

U. S. TOOL COMPANY, INC.,
Ampere, New Jersey

Send me the informative Bulletin on the U. S. Slide Feed.
I would like to see it "work". . .(check ☐ YES ☐ NO)

*Name and Title*_____

*Company*_____

*Address*_____

Its *Enforced* Accuracy never varies!

Exact feeding—even of non-uniform stock—is enforced by the U.S. SLIDE FEED

WHEREVER busy presses are dependent upon accurate feeding of coiled flat stock or wire, the U. S. Slide Feed will quickly demonstrate its ability to promote production speed and economy. It stops all of the wastes of material and labor, and prevents the costly work interruptions that result from inexact feeding.

Unfailing, never-varying accuracy is ENFORCED in the operation of the U. S. Slide Feed. An exactly determined length of stock is fed at every stroke...hour after hour and week after week...in spite of stock variations or other trouble-creating factors.

Investigate this Revolutionary Advance in Automatic Feeding

If you do any amount of punch-press work it will pay you to learn all about this revolutionary feeding mechanism.

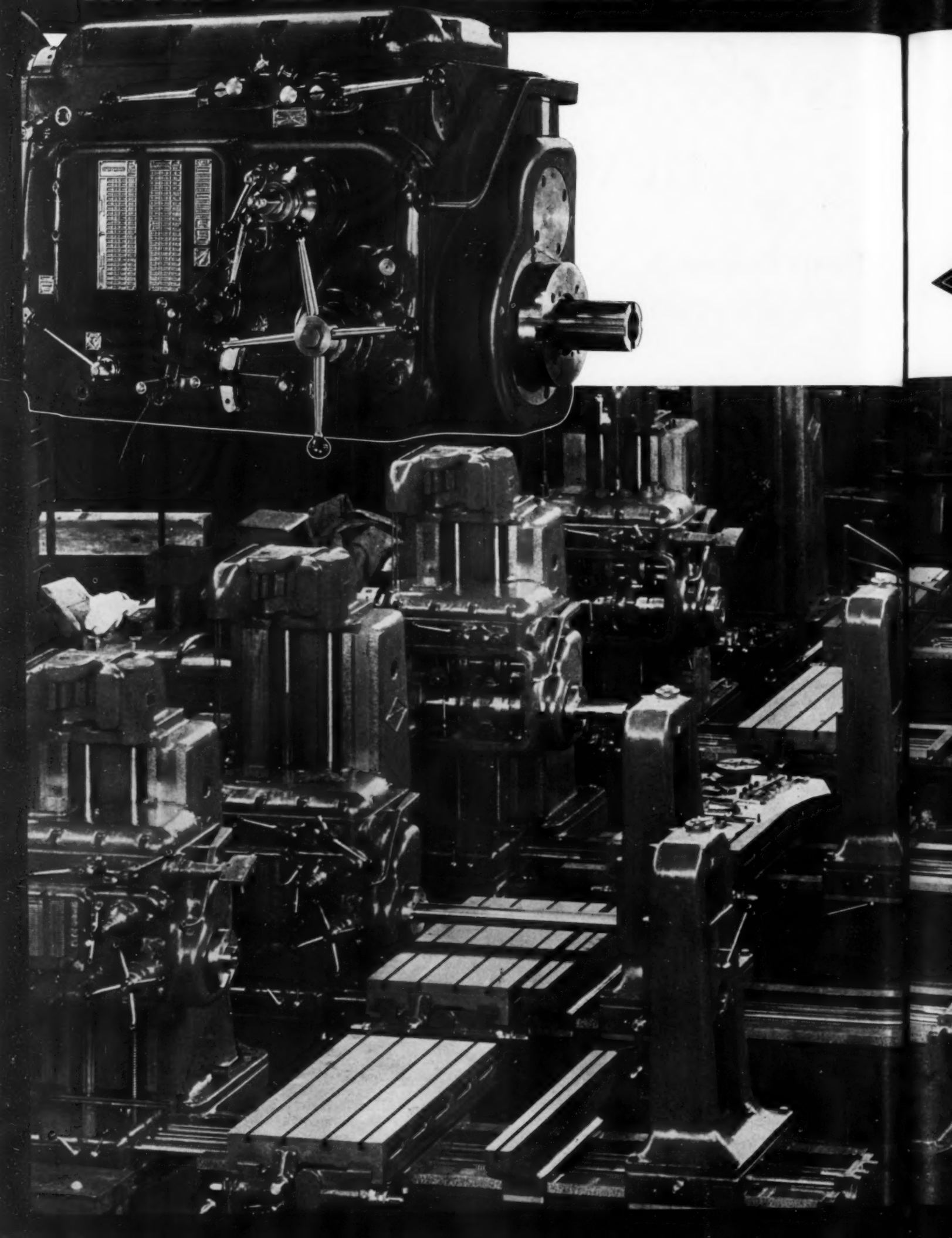
We would like an opportunity to show its advantages for a definite press job, also to arrange a demonstration at our plant or yours. To see the U. S. Slide Feed "work" is to realize how great an advance it represents over all former feed designs. Send the coupon on the opposite page for Bulletin which gives further details and new Reduced Prices.

Other superior U. S. Tool equipment for the metal stamping industry includes: Stock Reels, Straighteners for flat stock and wire, Stock Oilers, Die Sets and a full line of accessories.

U. S. TOOL COMPANY, INC.

AMPERE NEW JERSEY

APPROVED . . . SELLERS BORING



DRILLING AND MILLING MACHINES

with the unique Sellers Unit Head

A complete, self-contained, self-sufficient power unit with motor mounted on the head.

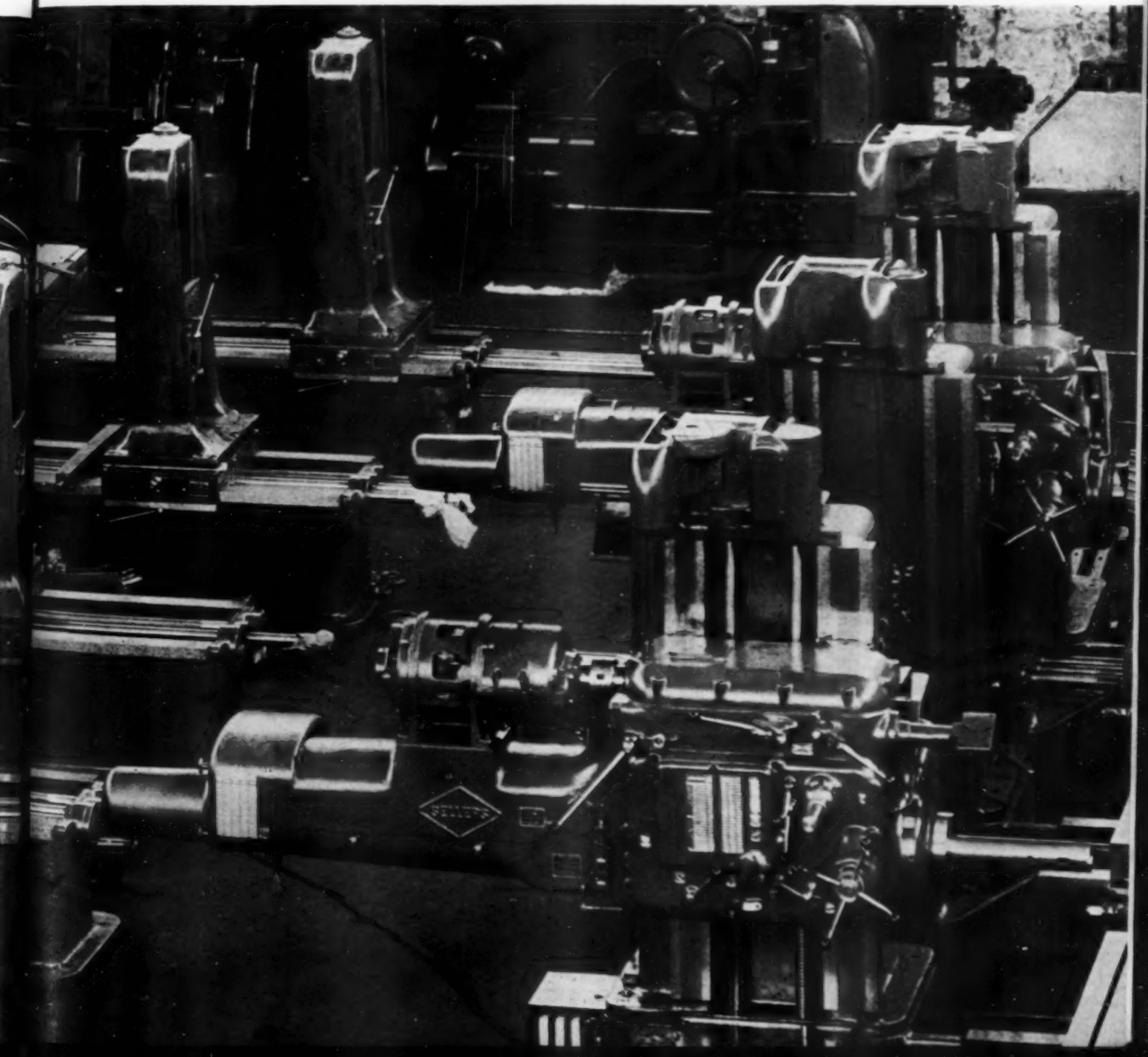
Direct application of power to the spindle insures high efficiency, smooth operation and steady power under heaviest loads.

All drives are from the head. All controls are at the head. Increased production through greater flexibility and operating convenience.

Built in table type, planer-table type and floor type machines.

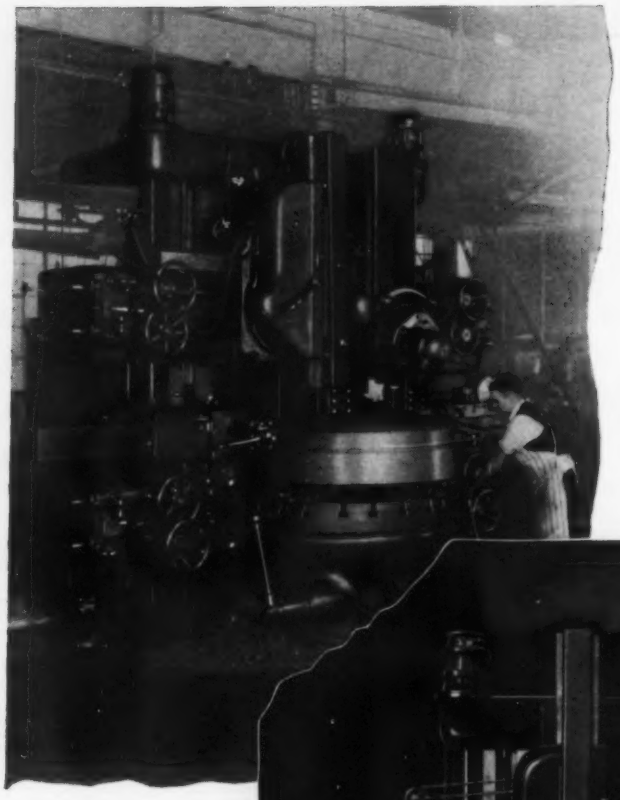
FOUNDED SELLERS 1848

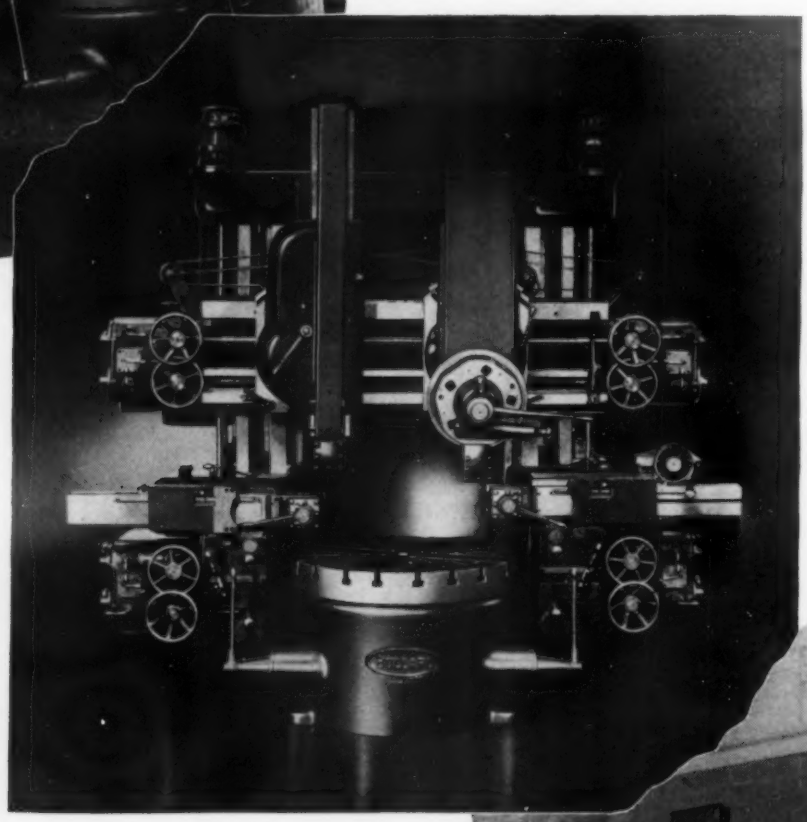
WILLIAM SELLERS & COMPANY
1600 HAMILTON ST. INCORPORATED PHILADELPHIA, U.S.A.



Savings with Modern Shop Equipment

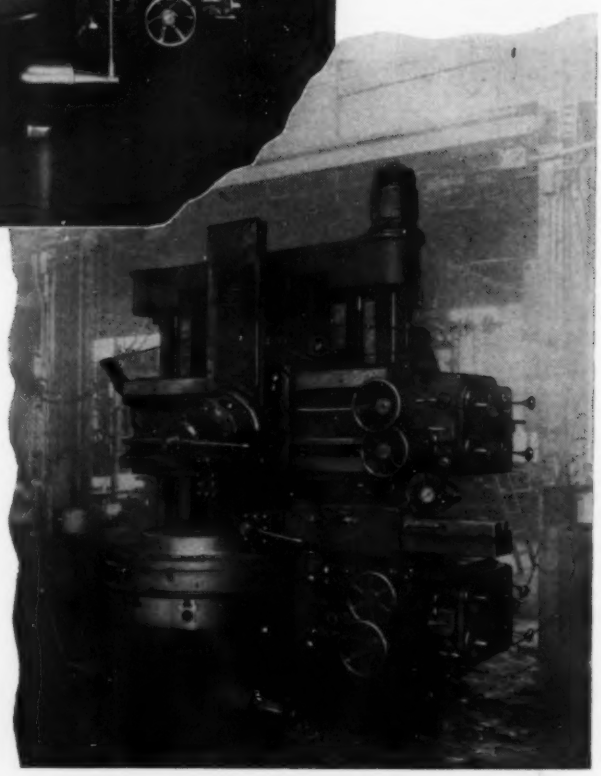
Modernization of plant equipment provides savings to meet the present higher costs of manufacturing. Bullard Hydro-Shift Vertical Turret Lathes provide many efficient and economical operating factors which aid in reducing or balancing these higher costs. As a matter of fact, these sturdy machines built in 46-in.—56-in.—66-in.—76-in. and 86-in. sizes afford maintained accuracy of machining, flexibility with attendant economy of production and safety in operation.





(Above & Center)
56″ Hydro-Shift Vertical Turret Lathe with 4-Head Combination

(Below)
46″ Hydro-Shift Vertical Turret Lathe with 2-Head Combination



Modern construction of Bullard Hydro-Shift machines means greater Safety and Efficiency of changing speeds, feeds and general operation, greater possibilities of heavier, faster cuts and, with two or more heads in operation, an assured saving of machining times.

Let Bullard Engineers tell you of the Profitable Advantages of these equipment units on your work.

THE BULLARD COMPANY

Bridgeport **Connecticut**

ARMSTRONG

Drop Forged WRENCHES

50 Types, All Sizes
1 Quality

Selected Chrome-Vanadium Steel

Special Carbon Steel

STANDARDIZE on "ARMSTRONG"

Standardize on ARMSTRONG Drop Forged WRENCHES to cut wrench costs . . . for consistently finer wrenches, improved designs, selected steels, accurate sizes . . . for longer tool life. With over 50 types, with a full range of sizes of each, there is an ARMSTRONG Wrench exactly suited to every job. In general ARMSTRONG Wrenches run longer — give greater leverage. Their improved pear-shaped heads fit more comfortably in the hand. Drop forged from special steel, heat treated and hardened, they have strength beyond any need and the toughness to stand up under all manner of abuse. Openings are accurately milled for U. S., S. A. E., American Standard, Metric and Whitworth measures. Their clean-cut jaws hold their walls, do not chew out like ordinary wrenches.

ARMSTRONG Carbon Steel Wrenches are uniformily finished in black enamel with heads ground bright and plainly marked for size. ARMSTRONG Chrome-Vanadium Wrenches are chrome plated over nickel; are longer, lighter, thinner — ideally suited for automatic machines and assembly work.

Standardize on ARMSTRONG WRENCHES to make work easier, faster, more profitable.

Write for New Catalog

ARMSTRONG Drivelock Socket Wrenches —*Sockets will not drop*

ARMSTRONG BROS. TOOL CO.

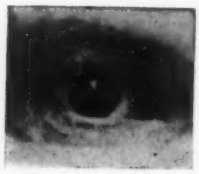
"The Tool Holder People"

315 N. Francisco Ave., CHICAGO, U. S. A.

New York Sales Office: 109 Lafayette St.
London Branch: ARMSTRONG BROS. TOOL CO. Ltd.

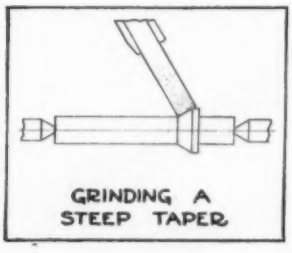
Look around

you may find many profitable uses for a Landis Hydraulic Universal !

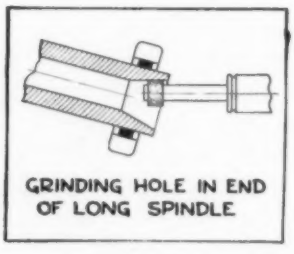


Yes, do look around. First in your grinding department. Undoubtedly you will find many grinding operations being performed on machines with universal features. But, are these machines truly productive? Take the grinding of steep tapers, shoulders, holes in the end of long spindles, loose cam grinding, face grinding with magnetic chuck, general face grinding and general internal grinding. These operations and many others of a similar nature represent a class, the grinding of which is frequently slow and costly unless high output justifies the use of single purpose machines.

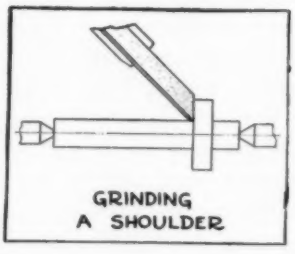
Look around again. This time in your tool room. Quantities here are, as a rule, much smaller than in your grinding department. Grinder efficiency is often not given the consideration that it is in manufacturing operations. Although the general sharpening of tools is best performed on a Tool and Cutter Grinder, operations such as the grinding of mandrels, boring bars, jig posts and certain dies may be taken care of much faster and better on modern universal machines.



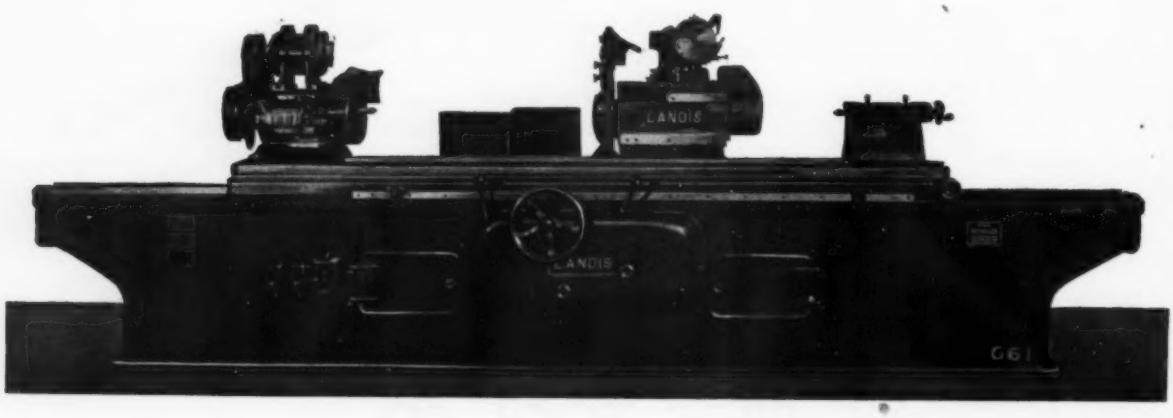
GRINDING A STEEP TAPER

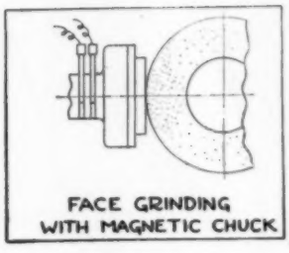


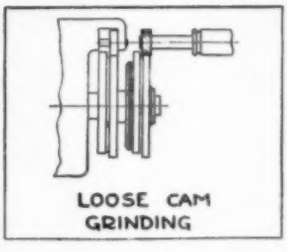
GRINDING HOLE IN END OF LONG SPINDLE

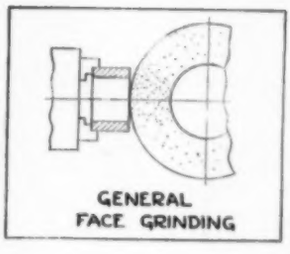


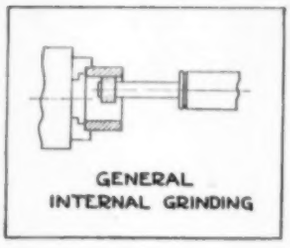
GRINDING A SHOULDER




FACE GRINDING
WITH MAGNETIC CHUCK


LOOSE CAM
GRINDING


GENERAL
FACE GRINDING

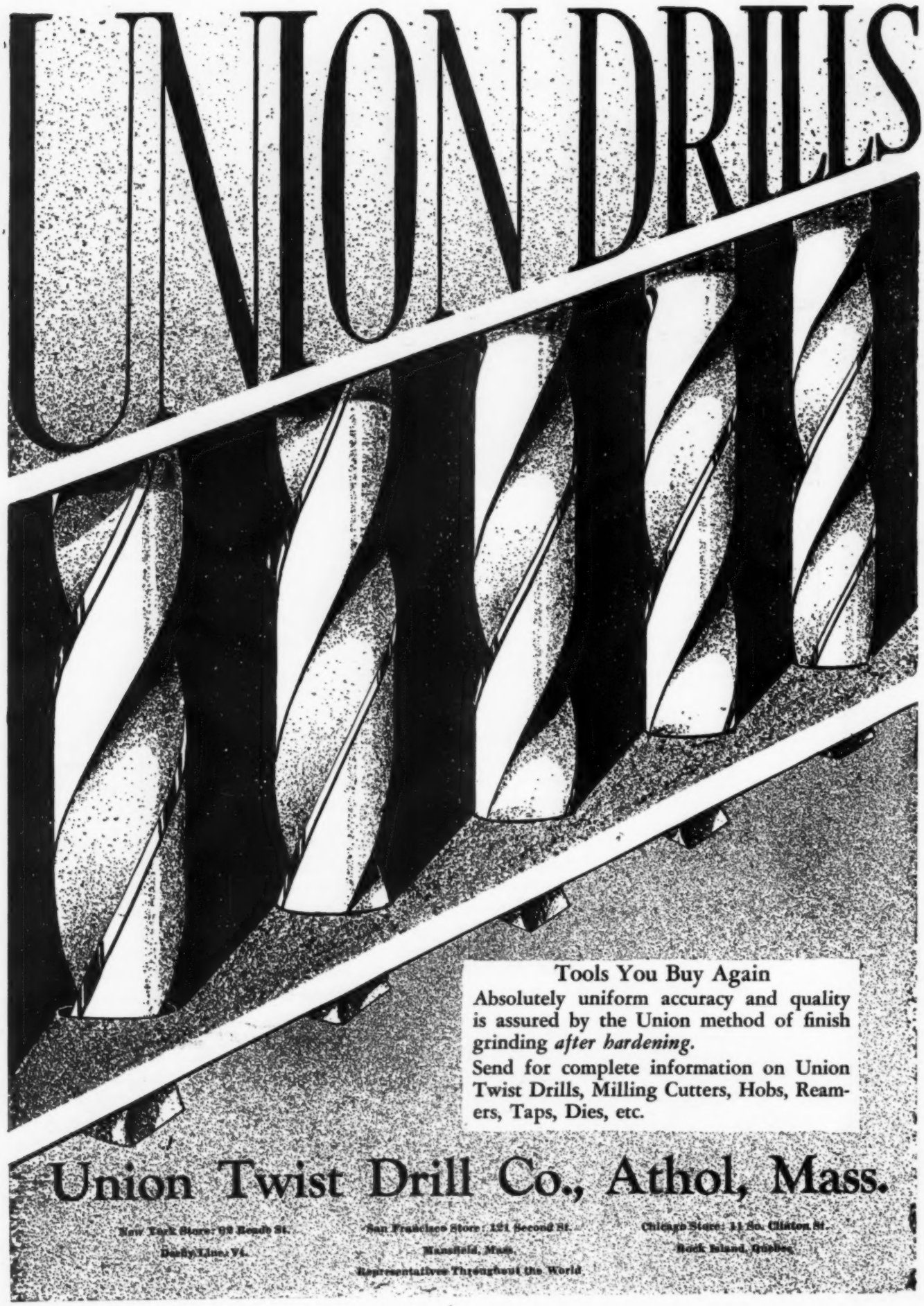

GENERAL
INTERNAL GRINDING

Finally look around in your machine repair department. Again quantities are small. The range of operations performed is great. Grinding equipment must be flexible. Universal machines are ideal, that is, provided they are sufficiently sturdy to turn out work rapidly.

All of the various grinder needs mentioned in the preceding paragraphs point toward the Landis Type C 14" Hydraulic Universals. These machines were designed with the idea of making available fully universal grinding equipment of sufficient weight, range and sturdiness to cause it to produce economically. On the opposite page the 14"x72" size is shown. Above is the 14"x36". Another size in between is the 14"x48". No detail will be gone into here regarding the design features of this new Landis equipment. Catalog No. L-33, which is yours for the asking, does this quite thoroughly.

When, upon looking around your plant, you find need for more efficient universal grinding equipment, it will be necessary to look no further than to the Landis Type C 14" Hydraulic Universals. They certainly are capable of many profitable uses.

LANDIS TOOL CO. 163
WAYNESBORO PA
DETROIT•CHICAGO•NEWARK•PHILADELPHIA


UNION DRILLS
Tools You Buy Again
Absolutely uniform accuracy and quality is assured by the Union method of finish grinding *after hardening*.
Send for complete information on Union Twist Drills, Milling Cutters, Hobs, Reamers, Taps, Dies, etc.
Union Twist Drill Co., Athol, Mass.
New York Store: 93 Reade St.
Derby Line, Vt.
San Francisco Store: 121 Second St.
Mansfield, Mass.
Chicago Store: 11 So. Clinton St.
Rock Island, Quebec
Representatives Throughout the World

When this CUTTER HEAD moves COSTS DROP...

On this new Van Norman Miller you don't move the work. You move the cutter head . . . *and save virtually all the man and machine time ordinarily spent in repeated set-ups.*

The original set-up is usually the only set-up. With a single cutter and without any attachments or fixtures, the No. 6 cuts vertical surfaces . . . horizontal surfaces . . . and all *angular* surfaces throughout the full run of the table. No re-setting. No complicated, time-consuming blocking. Simply loosen three bolts, adjust the pivoting cutter head to the new position —and start the cut.

The new No. 6 gives you all the Van Norman precision and flexibility at the lowest price in Van Norman history. If you handle a wide variety of work requiring many operations—tools, jigs, dies, patterns, core-boxes, or production parts—mail the coupon for our bulletin on the new No. 6.

The No. 6 Van Norman Miller cuts vertical, horizontal, and angular surfaces with equal speed and precision. Saves set-ups — time — money. Send the coupon for complete information and price — the *lowest* price ever asked for a Van Norman Miller.

VAN NORMAN
MACHINE TOOL COMPANY
SPRINGFIELD, MASSACHUSETTS
U. S. A.

GENTLEMEN Please send me bulletins describing the new Van Norman Millers and how they save set-ups.

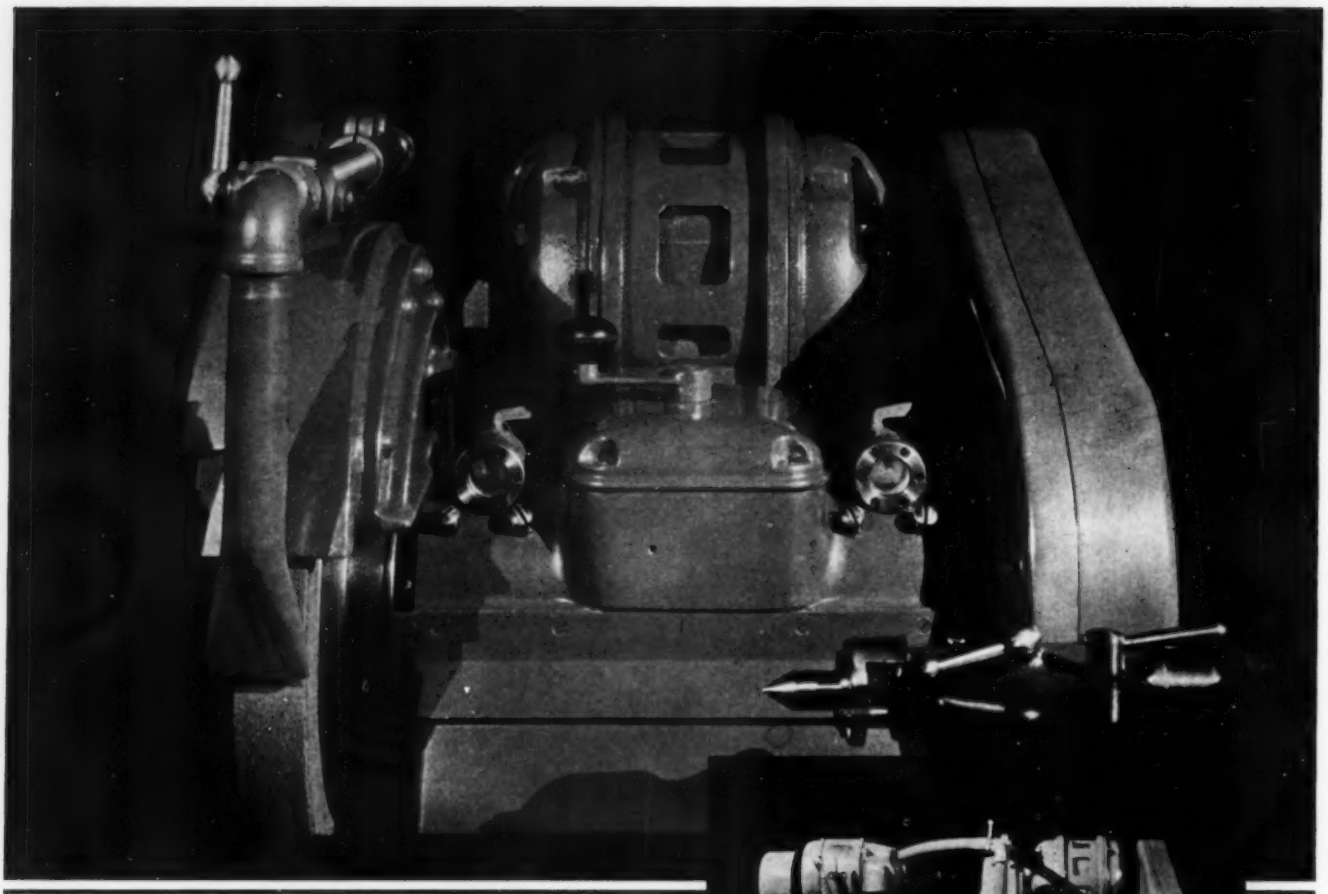
*Name*_____ *Title*_____

*Company*_____

*Address*_____

*City*_____ *State*_____

1404



NOW *The Popular Type C Features* in a 6″ Cylindrical Grinder

SELF-CONTAINED wheel unit with flood lubricated spindle bearings . . . Hydraulic table traverse . . . Forced-feed lubricated ways . . . Reasonable price . . . Features all, indeed yes — real features! And now they are incorporated into a neat, trim and well built machine for those small parts which must be ground accurately, rapidly and with a fine finish. If your production comes in this category you owe it to yourself and your firm to investigate this new NORTON.

NORTON COMPANY
Worcester, Mass.

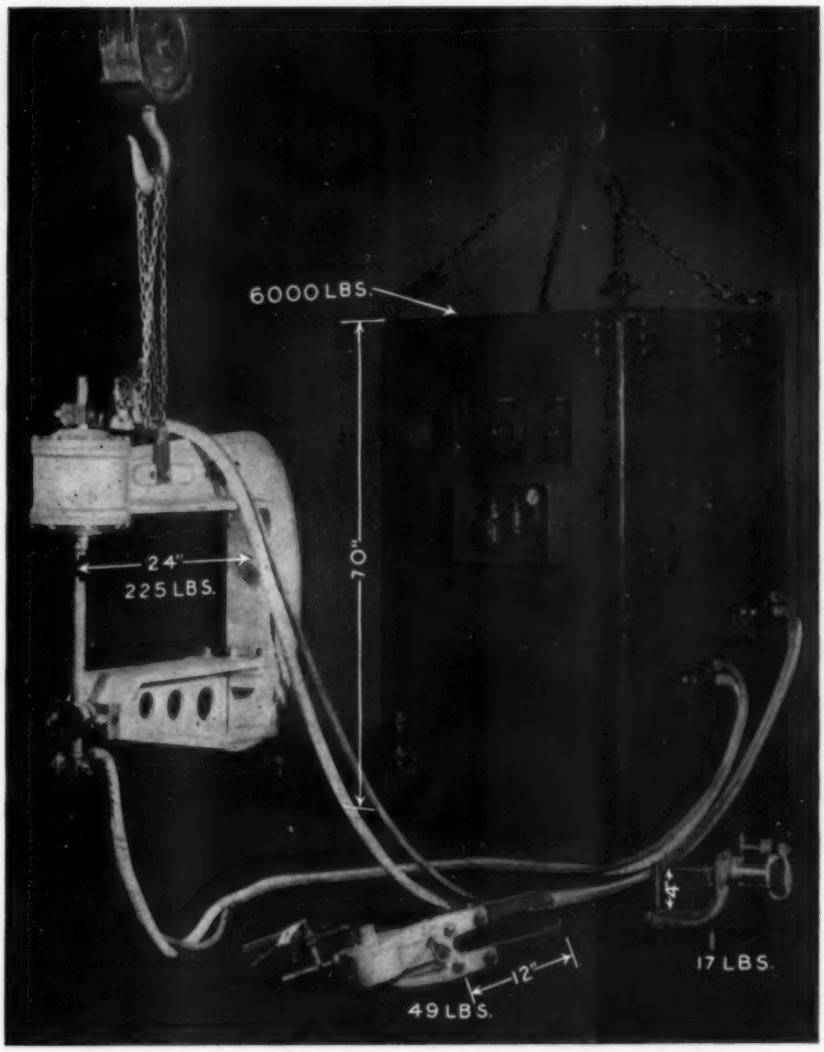
New York, Chicago, Detroit
Cleveland, Hartford
London

NORTON
GRINDING MACHINES

M-333

NORTON PRODUCTS—Grinding Machines; Lapping Machines • Grinding Wheels; Abrasives for Polishing; India Oilstones, Pulpstones • Laboratory Ware, Refractories; Porous Plates • Non-slip Tiles and Aggregates

When the fleet comes in . . .



Two of these modern
THOMSON-GIBB
SUPER SPOT WELDERS will be on the job at a PROMINENT NAVY YARD

Right now one of the big Navy Yards is being equipped with the last word in modern welding equipment — two of these big, portable THOMSON-GIBB Super Spot Welders.

These Super Spot Welders are equipped with 3 interchangeable welding guns. The big 225 pound he-feller with a 24 in. throat depth welds heavy roof or floor sheets to channeled roof trusses or cross members. The middle-sized or "flounder" type gun has a 12 inch throat depth. It handles all sorts of awkward jobs in close quarters such as welding vertical wall trusses or channel beams to side walls. The small hand gun welds wall sheets to flanged upright members. All of the guns are air operated and controlled by a push button switch.

The case holds the main welding transformer, an automatic transformer for 50-point heat regulation and the main circuit breaker. The machine is built for outdoor use with air-cooled transformers and leads and is normally weatherproof.

If your job is difficult or unusual and calls for something new in the way of size, performance or design, this application is excellent evidence to show that Thomson-Gibb has the knowledge and the ability to produce it. To get the one best solution to your welding problem, put it up to Welding Headquarters.

THOMSON-GIBB
ELECTRIC WELDING CO.
264 Pleasant St., Lynn, Mass.

6231

The trade-mark Silcrome on all grades of Ludlum stainless steel is your assurance that the steel was melted by Ludlum and processed under the most modern technical control.

MEETS *Every* NEED

Silcrome meets every need in stainless steel — and in each shape or analysis offers the finest quality of its kind. Whether you require heat-resistance, corrosion-resistance or workability, you will find it worth while to specify Silcrome. Two mills and 17 warehouse stocks contribute to extra rapid delivery service.

If you use Stainless Steel, it will pay you to read the Ludlum Silcrome Blue Sheet. It will be sent you free, with absolutely no obligations. It contains no ballyhoo — just plain, unvarnished facts — determined by careful laboratory tests — tabulated so that you can easily and quickly see which type of Silcrome possesses the physical qualities that you need.

Just mail the coupon below and we shall send you the Silcrome Blue Sheet. It will help answer the questions — Why Silcrome? and, Which Silcrome?

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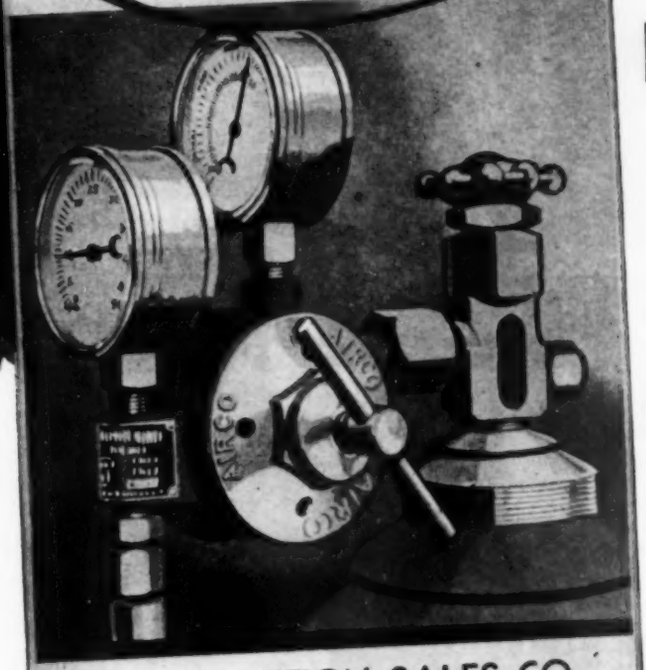
TOOL STEELS · SILCROME · NITRALLOY

AT LAST . . . automatically maintained pressure regulation



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Wagner Type CP Motors

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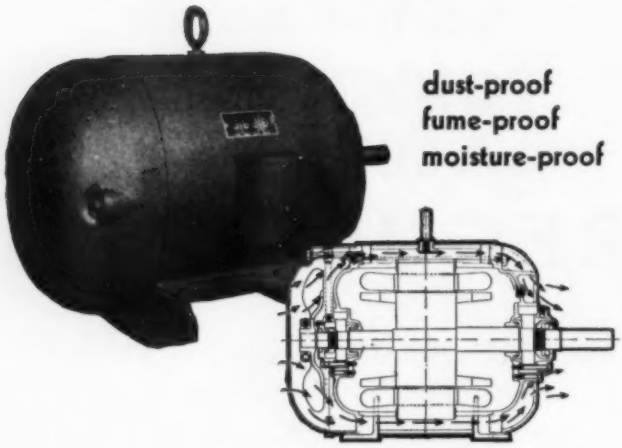

dust-proof
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Why put up with shutdowns to clean out motors, curtailed production during these shutdowns, and the maintenance expense involved?

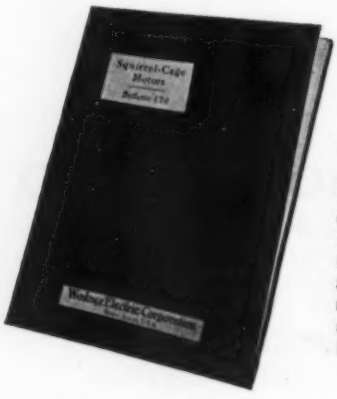
When Wagner type CP totally-enclosed fan-cooled motors are used, such shutdowns and maintenance expense are eliminated.

These motors are provided with two frames—

—an outer frame which guides a strong cooling draft over the motor

—an inner frame thru which nothing obstructive or injurious can get into the motor.

Lower your overhead—stop production losses—with Wagner type CP motors.



Ask for Bulletin 174 !

In Part 5B of Bulletin 174 is a complete description of Wagner type CP totally-enclosed fan-cooled motors. Ask for a copy - - - and read not only about type CP, but also other types of Wagner squirrel-cage motors described in this 48-page bulletin.

Wagner Electric Corporation

MOTORS TRANSFORMERS FANS BRAKES

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Please send copy of Bulletin 174 containing description of Wagner type CP motors.

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Ground Thread High Speed Steel

Machine Screw Taps

No. 1120 Regular

No. 1122 Spiral Pointed

Features . . . Furnished in plug style only.

Ground to tolerances shown in Catalog 33, Table 229.

Cut back relief.

Made in sizes Nos. 6 to 14, inclusive.

No. 6 three flutes—others, four flutes.

Spiral pointed are two fluted.

Recommendations . . . For high production tapping where accuracy must be controlled.

Use No. 1120 Regular for screw machine tapping and for blind holes.

No. 1122 Spiral pointed for through holes in all metals.

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Send for circular on designs and recommended uses of CARD Machine Screw Taps

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GRATON & KNIGHT Engineers have produced an entirely NEW kind of belting to match the economies of MODERN GROUP DRIVE

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□ **This Graton & Knight Research Flat Leather Belting assures the full benefits and economies of the Modern Group Drive. It has consistently averaged only ONE take-up to 3 or 4 take-ups for other leather belting under identical operating conditions. It has consistently carried full rated loads for weeks without any take-up at all and even then has required no further maintenance for a year or more, except occasional dressing.**

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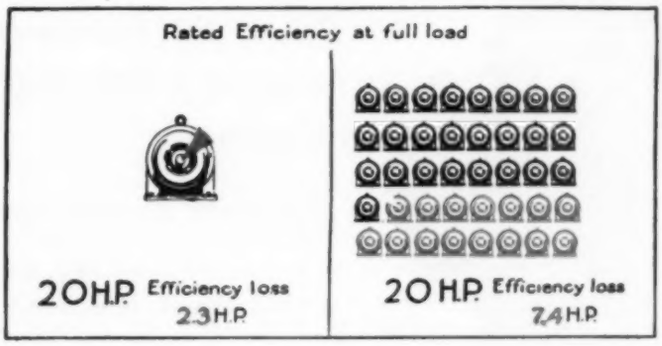
As an essential part of the Modern Group Drive these important betterments in belt manufacture and performance safeguard your investment and assure the full benefits and economies of this new drive system.

Our local power transmission man knows this interesting story thoroughly. He can show you facts and carefully checked operating data to confirm every statement we have made. He can help you make definite savings NOW in your own plant. Write Graton & Knight Company, Worcester, Mass.

HIGHLIGHTS OF THE MODERN GROUP DRIVE



LARGER H.P. packages give you more for your money

This chart shows the efficiency losses in large and small motors of the same total horsepower, according to standard motor rating tables.

There are some drives in every plant where the advantages of the individual motor installation make these losses of slight importance. But where many machine units maintain steady production, the greater motor efficiency of Modern Group Drive represents a substantial saving.

This chart is taken from a booklet published by the Mechanical Power Engineering Associates, and giving in simple, non-technical form the results of a two-year study of modern group and unit drive systems in Industry. We will be glad to send you a copy on request. Write us.

Research Performance Facts tell their own story

The master mechanic of a washing machine plant was so well pleased with the performance of his first Research Belt drive, that he immediately ordered five more.

●

Here's the data on grinder installation in a Pennsylvania Steel plant. Motor 15 hp. at 1800 r.p.m. Motor pulley 8¼"x7¼" face; driven pulley 10¼"x7¼" face. Centers 20", length of belt 5' 10".

Life of Research Belt so far 14 months; maintenance cost. . . . NONE. Combined life of *two* previous belts . . . 12 months; shortened *3 times*.

●

An interesting test was recently run on a heavy timber planer. This machine uses two similar belt drives, one of which was equipped with a 6" G & K Research (quarter turn drive) and the other with a competitive first grade belt. The research showed no apparent stretch after 72 hours operation. The other stretched so much in 30 minutes that it had to be taken off. Tough drives emphasize Research qualities.

●

From a paper mill comes the story of a 3¼" Research Belt on an exceedingly difficult six-pulley drive with double reverse and with the belt wrapped twice around a core arbor on the machine. Research lasted just three times as long as the best previous belt.

NRA

GRATON & KNIGHT Research LEATHER BELTING

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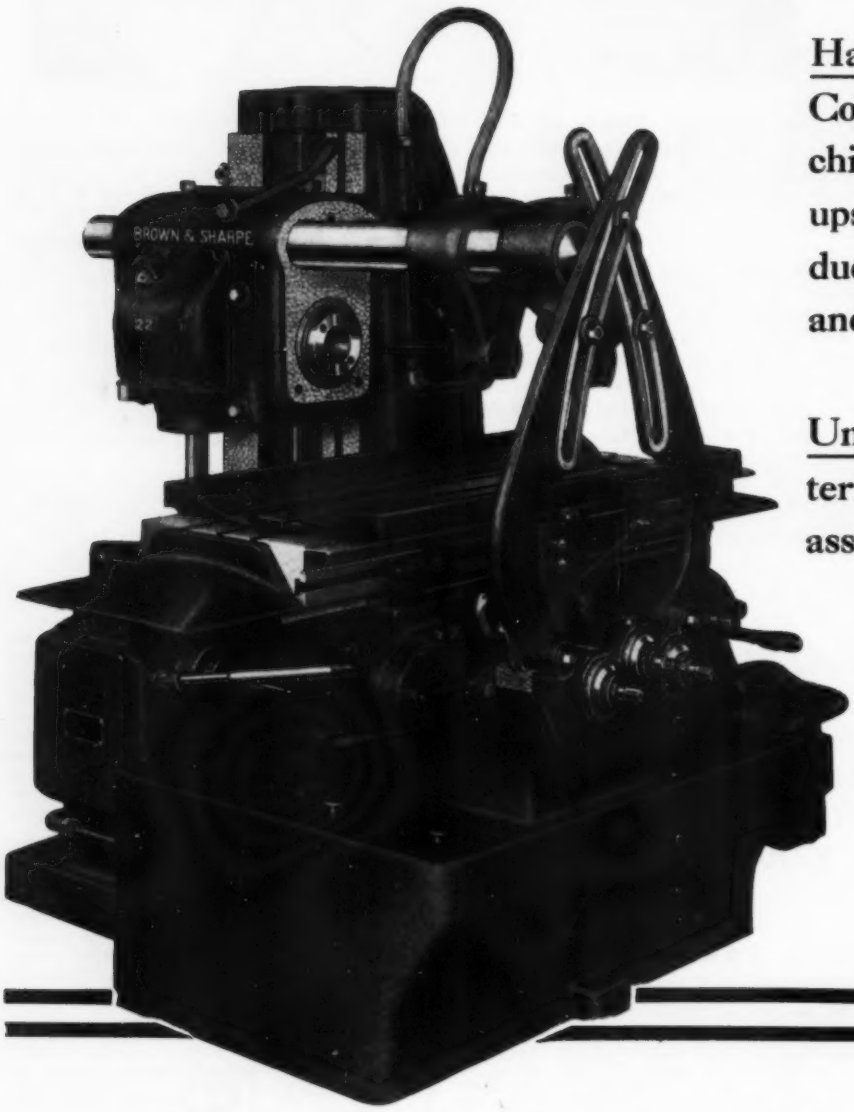
Giving—The Flexibility of Control of the "Column and Knee Design"

Combined with— the Production Advantages of the "Bed Type Milling Machine"



Handy Control (as in the Column and Knee Machines) permits quick setups and reduces non-productive time on both short and long run jobs.

Unusual Rigidity (characteristic of the bed type) assures full productive efficiency with the maintenance of a high degree of accuracy.

Investigate its advantages!

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№22 PLAIN MILLING MACHINE

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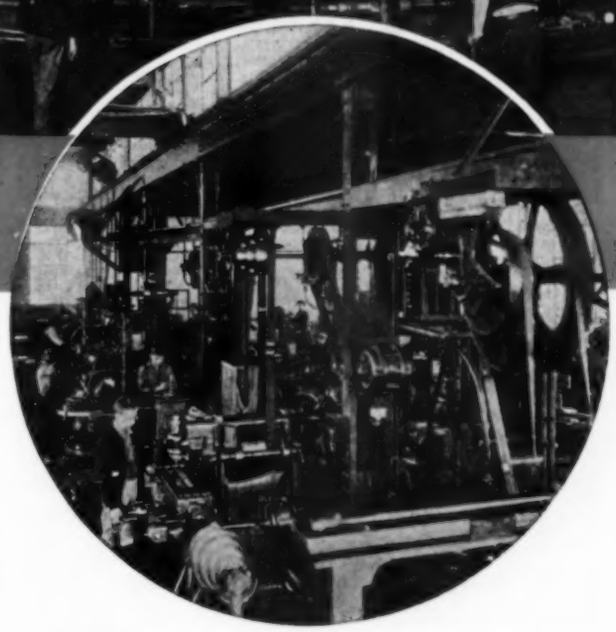
NOTE:
The booklet shown below will be sent to all metal working plant operators who mail the coupon. Your copy is ready.

The Beckley Machine Co. is one of the leading plants which make a specialty of repairing and rebuilding coal mine equipment. Gulf lubricants and cutting oils have made real records of economy in this plant.

Gulf Lasapar Cutting Oil is used in the Beckley plant for all tooling operations. Because of its high quality, this oil has been found to be a most economical cutting agent in many machine jobs.



. . . Beckley Machine & Electric Co. keeps maintenance and lubrication costs down with Gulf products.

FROM precision machines to heavy presses, the varied equipment in the plant of the Beckley Machine & Electric Co. at Beckley, W. Va. is kept in efficient operation with Gulf lubricants.

The management of this plant reports that Gulf products have been an important factor in keeping their maintenance and lubrication costs at a minimum.

In machine shops of all types, Gulf lubricants and cutting oils are making real records of economy. Gulf's *complete* range of oils and greases permits the selection of just the right type of lubricant for each machine and each process.

To assist metal working plants in setting up a simple system of lubrication cost recording, Gulf offers the booklet shown on this page. It will help you definitely establish the efficiency of your lubrication.

GULF REFINING COMPANY, Pittsburgh, Pa.

District Sales Offices:
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This booklet will help you determine the real influence of lubrication on your operating costs. Write for it today.

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Title.....

Company.....

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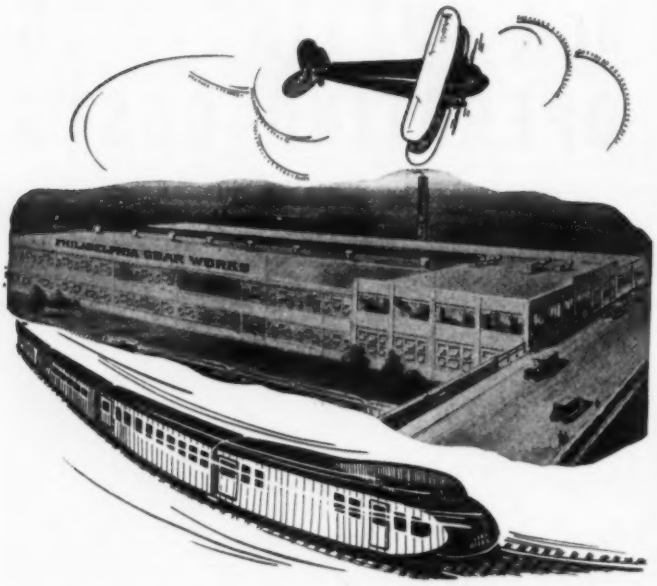

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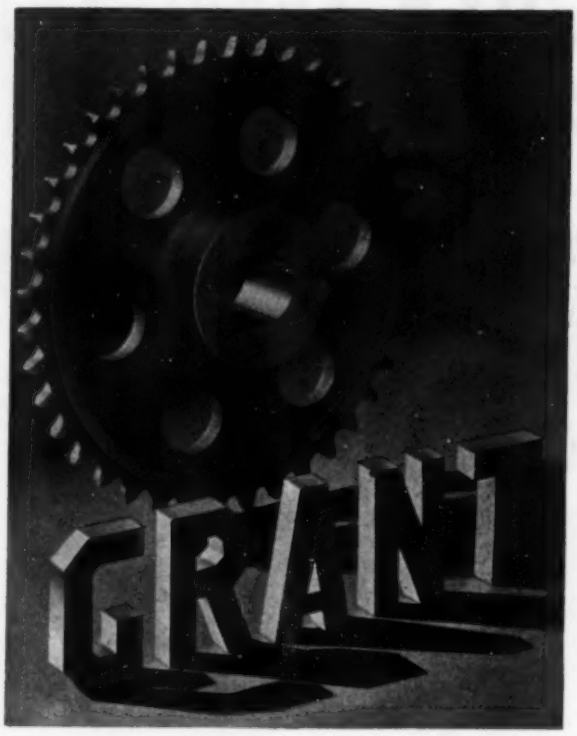

The name Grant is a safe guide to reliable gears. Spur, bevel, mitre, internal, worm. Ratchets. Roller chain drives—silent chain drives. Reduction units.

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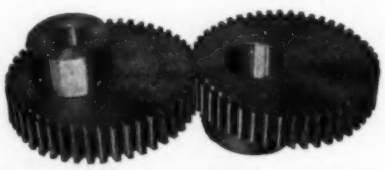

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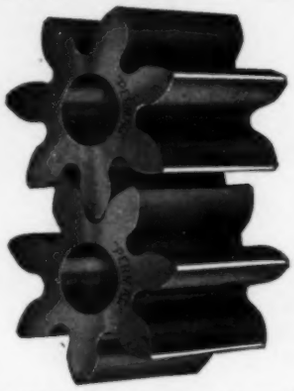

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And it isn't entirely because they get the benefit of our mass-production savings in manufacturing costs. There's always an extra margin of quality in Perkins gears — an extra degree of accuracy—that makes them run more quietly and last longer.

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DART bronze-to-bronze UNIONS

Two bronze-to-bronze seats, ground to a perfect, leak-proof fit, give double life to Dart Unions. *A free sample to prove it!* Write for it—and for new Catalog and Price List No. 4-30.

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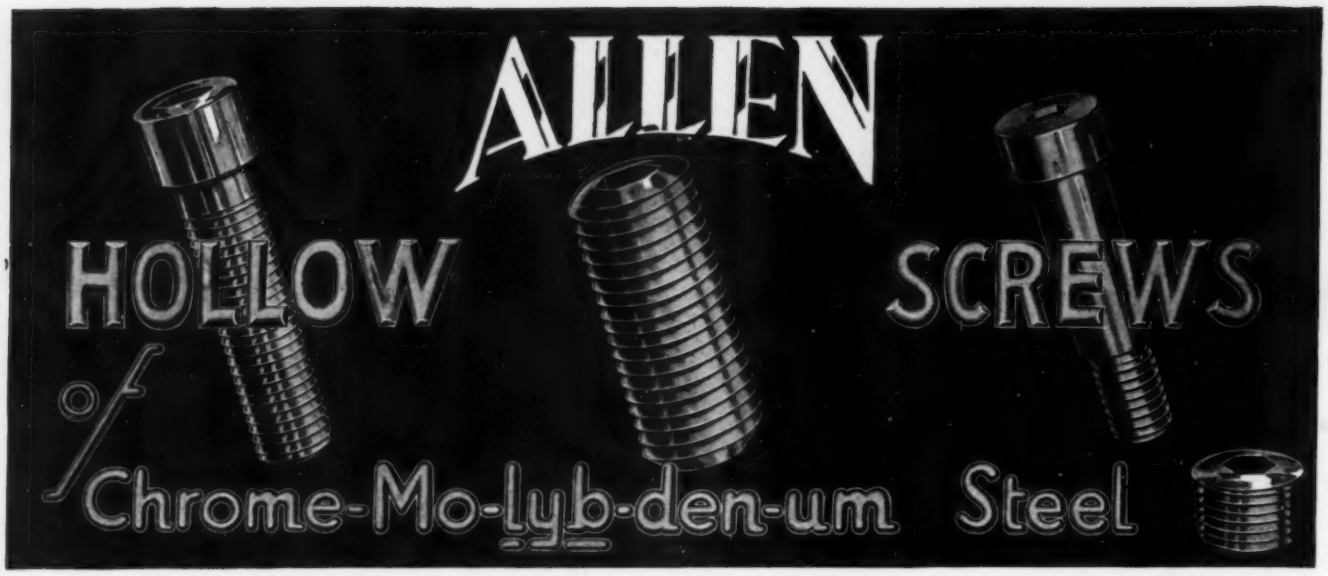

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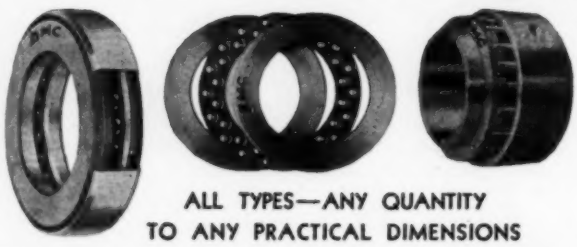

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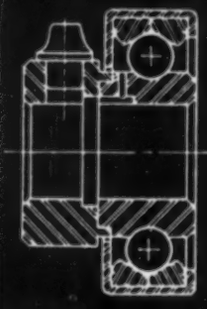

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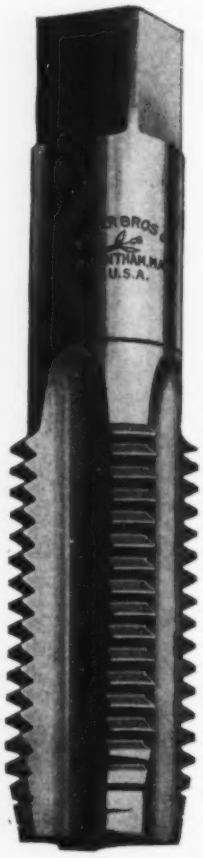

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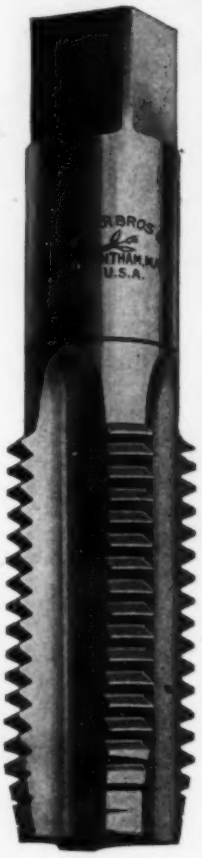

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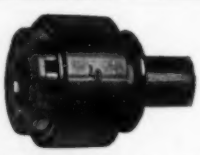

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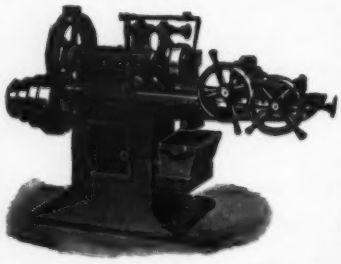
Strength and Weight



help to give Acme Bolt and Nut Machines their undoubted superiority as immediate cost reducers on all work in their capacity.

They turn out work faster than others and perfect accuracy can be depended upon. Write us for description of our entire line. Catalog?

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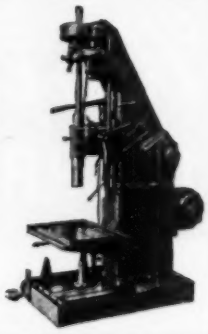
We specialize on high-grade drilling machines for maximum production at minimum cost. Versatile No. 262, illustrated, is unexcelled for general purpose work. Many other types available. Get details.



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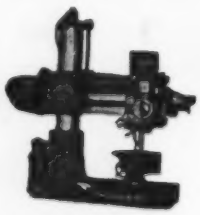

The Carlton All Ball Bearing Radial Drill pleases its users. Has done so for TWELVE YEARS and will continue to do so. Learn all its features and you'll see why.

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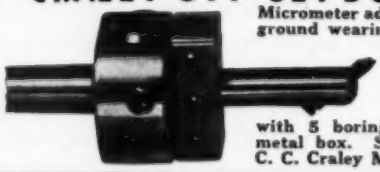

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FOOTBURT Cam Feed Units offer a most desirable way of building up equipment to handle automotive valve hole operations. The cam provides the proper feed for variations in hole size and the accurate dwell required on such operations as qualifying and seating. Units are self contained, making a very simple machine possible.

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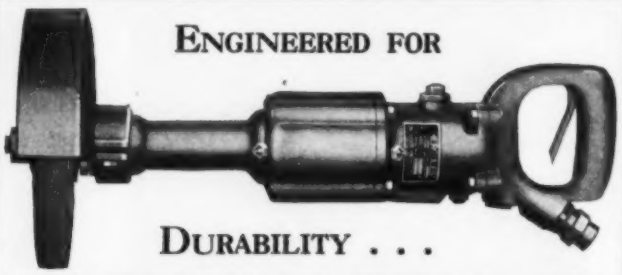

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NEW This No. 25 GRAND RAPIDS 6 in. x 18 in. Hydraulic Feed SURFACE GRINDER

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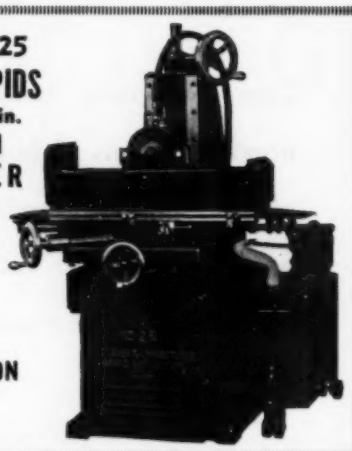

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Announcing A COMPLETE NEW LINE OF FOUNDRY AND BILLET GRINDING WHEELS

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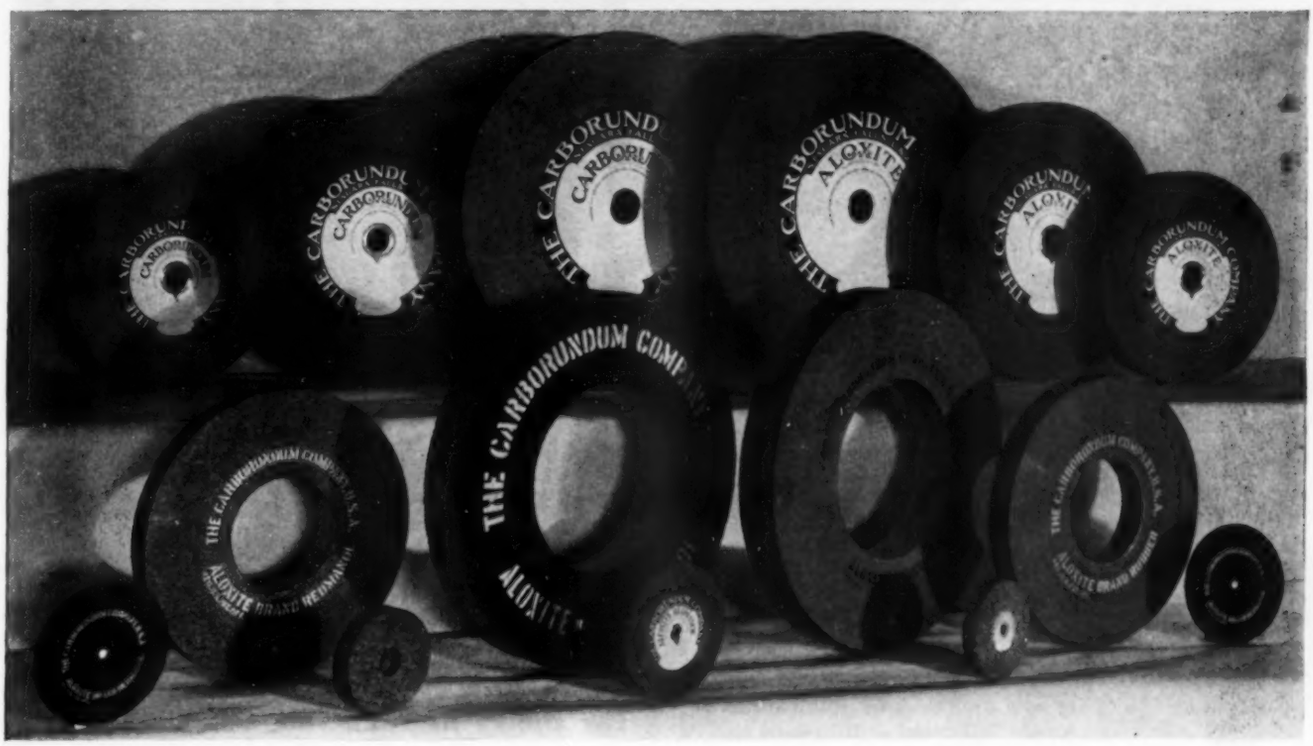
New IMPROVED RUBBER BONDED WHEELS



These wheels set new standards in foundry and billet grinding practice

FOR some long time we have been concentrating on the improvement of foundry and billet grinding wheels—new bonds, new types of wheel structure, closer gradings.

Now we can announce, after exhaustive field tests, the setting of new production and grinding cost standards. These improved wheels range from those for portable grinders to the large, heavy, snagging wheels for malleable and steel foundries.

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These wheels will lower costs throughout the entire industry—the steel, malleable, manganese and grey iron foundries—the stainless steel and iron alloy plants.

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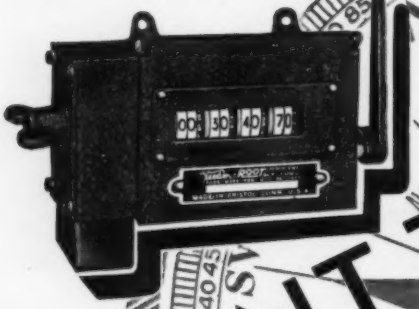
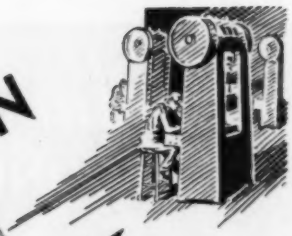


POINT THE DIRECTION



to SAVINGS otherwise overlooked —in cost per piece at each individual machine

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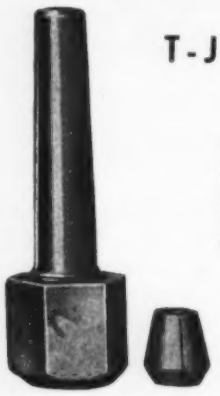

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to hold straight shank milling cutters, for use in Vertical or Horizontal Milling Machines. Furnished with standard taper shanks, tapped, as shown or with tang.

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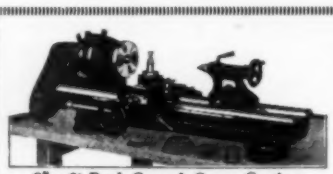

9" x 3' Back-Geared, Screw Cutting "Workshop" Bench Lathe.....$75

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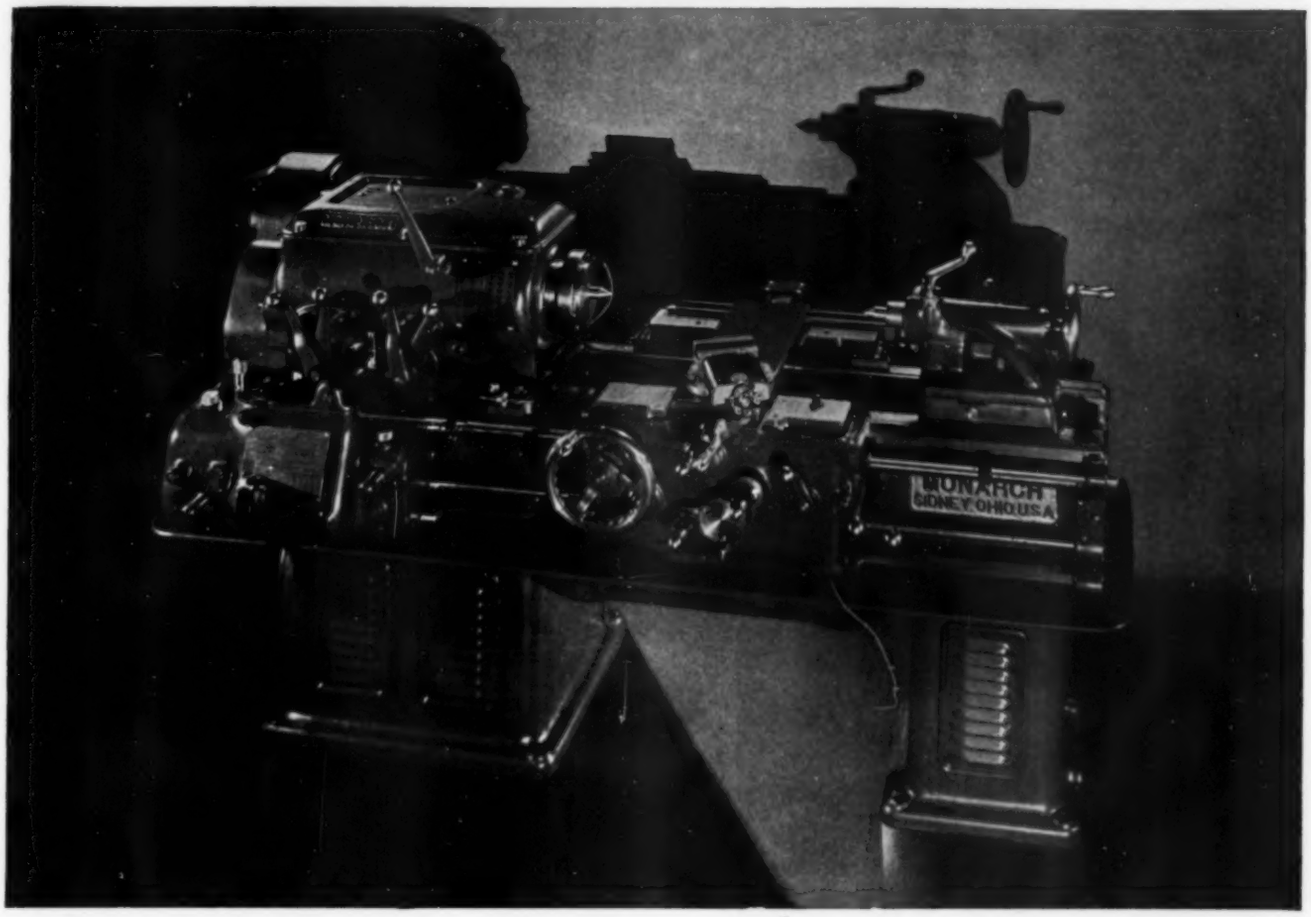
CUT YOUR TOOL ROOM COSTS !



AS YOU make your modernization plans for 1935, consider your lathes from the point of view of the profit you can make from their operation.

The Monarch Tool-Room Lathe, illustrated above, is regarded as today's very finest precision lathe. It will cut your costs materially. New in design, new in construction, tried and proven in operating efficiency, incorporating a wealth of new improvements, it enables you to reach the efficient and economical production that today's keener competition forces on you.

The Monarch line includes:

Engine Lathes in all sizes and swings from 12" to 36", inclusive;
Tool Room Precision-Type Lathes, in sizes from 12" to 18", inclusive;
Monarch Keller Automatic Form-Turning Lathes, in all sizes and types;
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Monarch Magna-Matic All Electric, Full Automatic, Double Carriage Lathe . . . Suitable for machining parts in small as well as large lots;
Monarch Precision Tool-Room Surface Grinder.

SPECIAL LATHES FOR DOING THE UNUSUAL AND DIFFICULT JOBS

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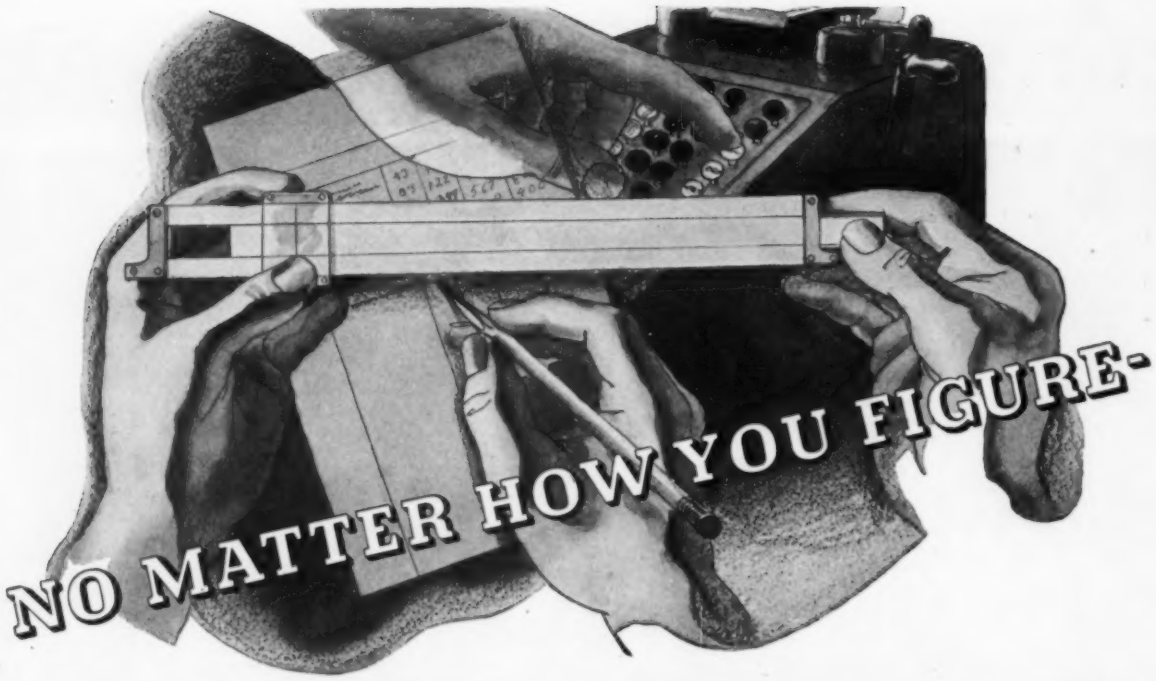
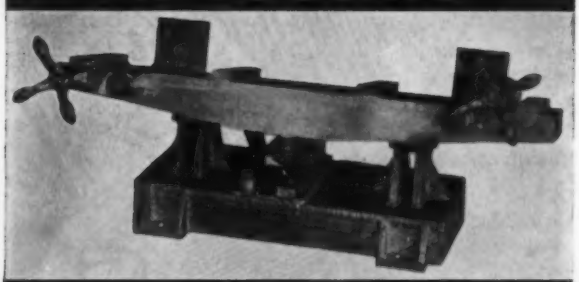


. . . you save with a "SHIELD-ARC" WELDER . . .



"Shield-Arc" is guaranteed three ways to produce more welding per dollar. Its eleven features, combined in no other welder, make this guarantee possible. For example, the uniformity of its welding current allows use of a higher average current with less splatter and loss of electrode metal. More of the electrode metal goes into the weld. And its high capacity lets you use larger size electrodes with a saving up to 25 per cent of former welding costs.

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W-84

LINCOLN "SHIELD-ARC" WELDERS

Real WORKING DATA for TAP USERS

The new 198 page Butterfield Catalog contains complete information on all Butterfield products, but goes much further than that with respect to taps and dies.

Fifty pages are devoted to tables and data of practical value to all manufacturers or users of screw-thread products—much of which are not available elsewhere.

The Tap Section illustrates and describes our complete line of taps for all hand and machine requirements. Practically all types and sizes are available in four different grades as follows:

1 Carbon Steel Cut-Thread Taps

2 High-Speed-Steel Cut-Thread Taps

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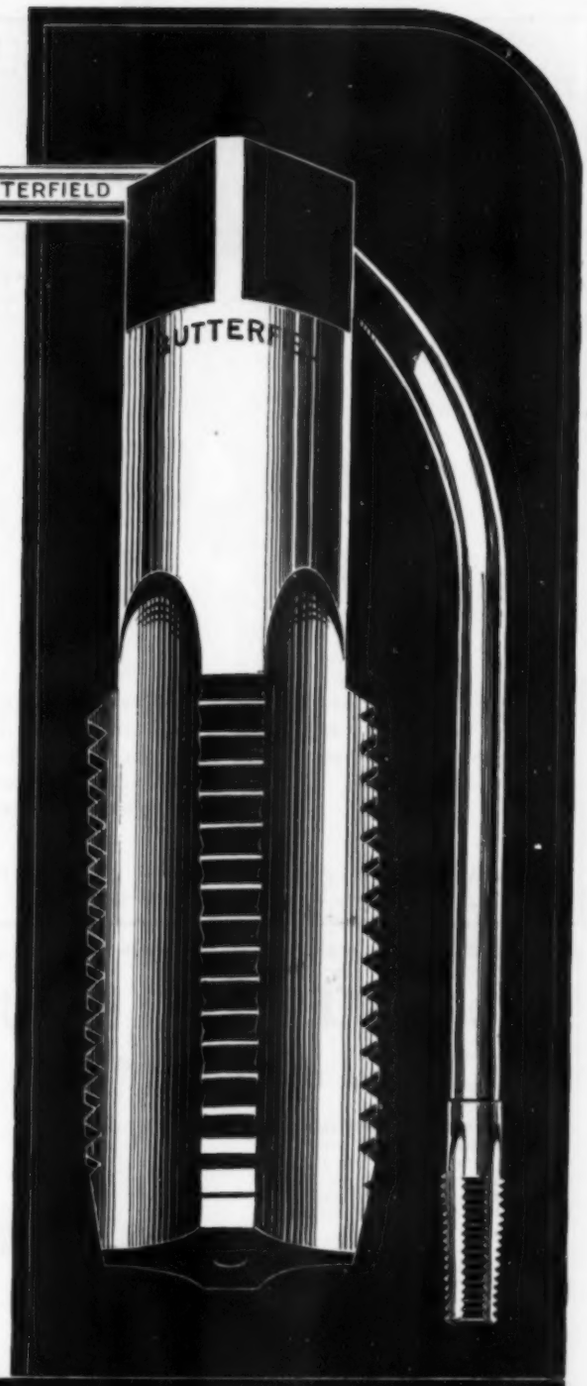
4 High-Speed-Steel Precision Ground-Thread Taps

We want everyone who needs this new catalog to have it as soon as possible, and will send a copy free of charge post paid, promptly on request.

Fill out the handy coupon and mail it NOW.



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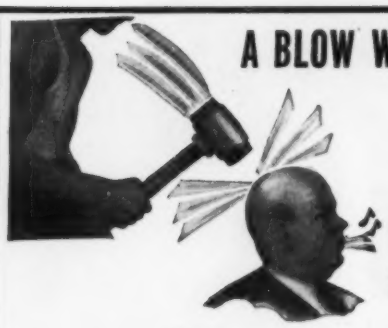
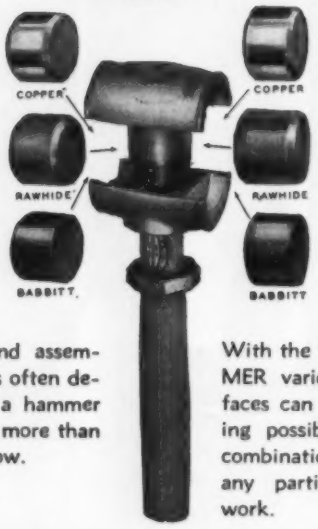


A BLOW WITHOUT A DENT

WITH THE

"BASA" HAMMER

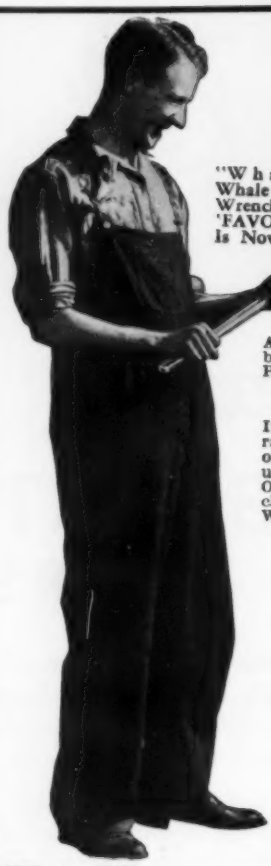
Any combination of faces can be quickly obtained.



Made in Five Sizes

In finishing and assembling work it is often desirable to use a hammer that can strike more than one kind of blow.

With the "BASA" HAMMER various kinds of faces can be used, making possible the desired combination of faces for any particular class of work.



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FAVORITE

Reversible Ratchet

WRENCH

"What a Whale of a Wrench the 'FAVORITE' is Now!"

NEW MODEL with CADMIUM FINISH

A stronger and better metal is now being used in Handles, Heads and Pawls, as well as other improvements.

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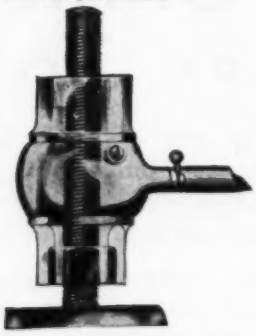
It works on a quick, straight-ahead ratchet movement, and the socket form of head is not removed from the nut until operation is completed.
Opening in head allows bolt to pass clear through.
Write for full particulars.



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with unskilled labor!

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All standard types of oil grooves can be cut on the WICACO Groover—at marvelously rapid speed—only spindle adjustments being necessary to change from one type to the other. Write for complete catalog—and send us samples of your work so that we can tell you what your grooving cost should be.

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The WICACO MACHINE CORPORATION

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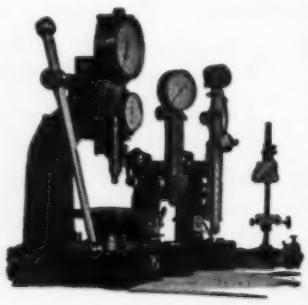
Should Be Made With Up-to-date Equipment — You cannot afford to experiment.



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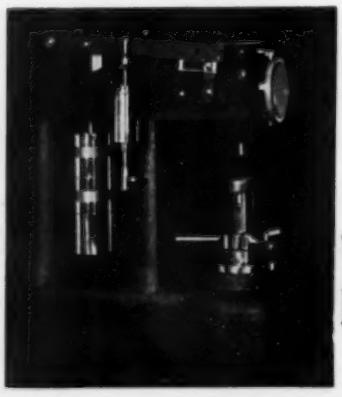

"ROCKWELL" HARDNESS TESTER

Made by

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736 East 143rd St.

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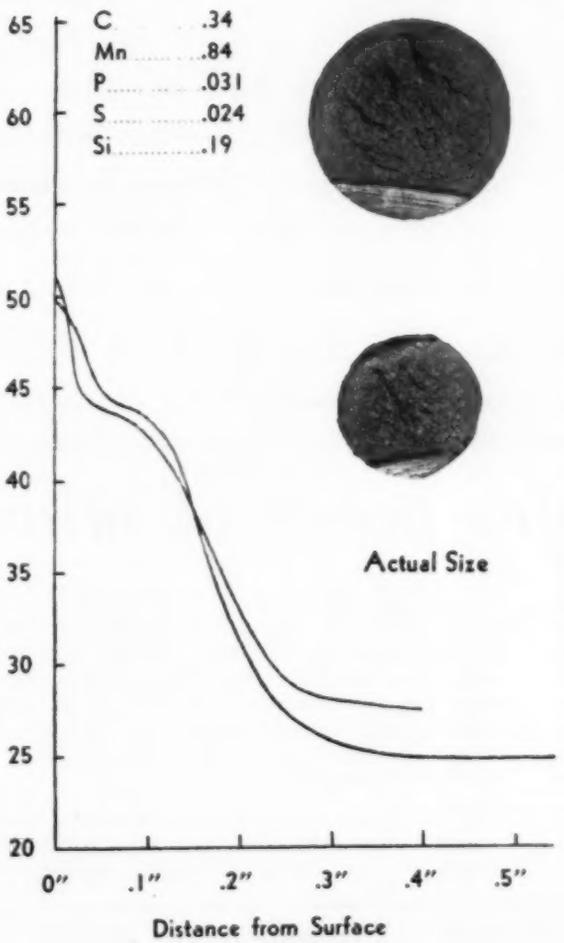
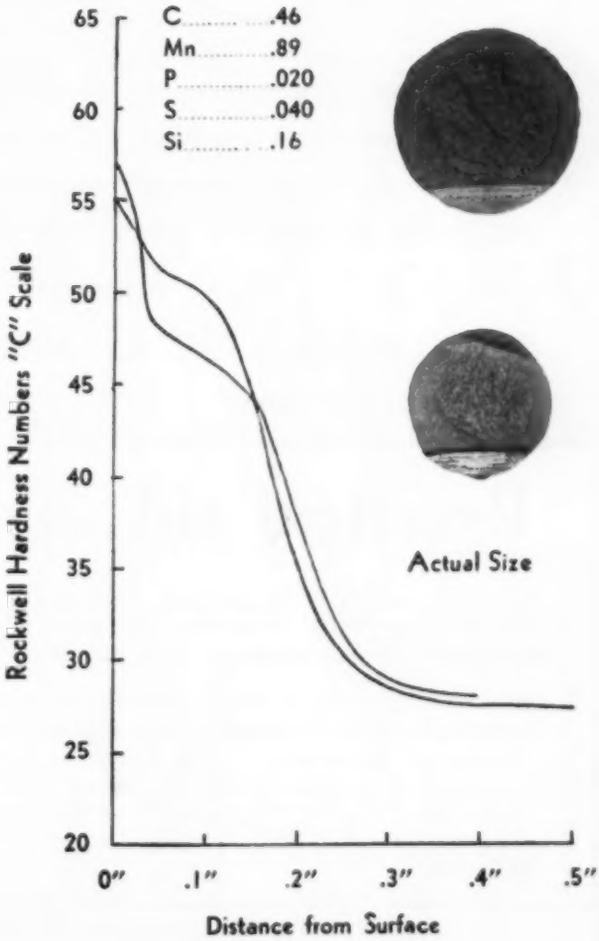
WYCKOFF *Controlled*
COLD DRAWN STEELS





Wyckoff Controlled Steels have established convincing proof of what modern metallurgy has accomplished in *refinement of steel practice*. The much talked of *uniformity of product* is now an established fact. Our experience with each accomplishment in *Controlled Steels* enables us to give you the latest and most economical recommendations for your steel problems which will result in a decided *cost saving*.

Tons of Wyckoff Controlled Steels have answered the call for that *constant uniformity* of *product* which must and can be duplicated in every heat. *Wyckoff Controlled Steels* have solved many practical problems dealing with *surface hardness penetration*.

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You are invited to consult our Metallurgical Department on your particular requirements.

WYCKOFF DRAWN STEEL COMPANY

General Offices: First National Bank Bldg., Pittsburgh, Pa.
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Manufacturers of

Cold Drawn Steels Turned and Polished Shafting Turned and Ground Shafting

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are used to secure accurate measurements in making and inspecting limit or standard gages—to establish standard sizes—and for checking precision in all kinds of toolmaking and laboratory work. They save time on tool, jig, fixture, gage and production operations. Available in Inch or Metric System.

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No. 13B Brown & Sharpe Plain Milling Machine, National standard
No. 4 Cincinnati Universal Milling Machine, s.p.d.
No. 2, 3, 4, 5 Cin. Plain Milling Machines, s.p.d.
24" Cin. Automatic Duplex Milling Machine, m.d.
24", 48" Cin. Pl. Auto. Milling Machines, s.p.d.
No. 3A Heavy B.&S. Univ. Milling Machine, m.d.
No. 3 Cincinnati Vertical Milling Machine, s.p.d.
No 72A3 Heald Sizematic, two motor drive, latest
10x36", 10x50" Norton Pl. Cylindrical Grinders, m.d.
No. 11 B.&S. Plain Cylindrical Grinder, m.d.
6x18", 10x36", 16"x52" Landis Plain Cylindrical Grinders, m.d.
No. 51 Besly Motor Driven Disc Grinder, m.d.
No. 2 Oesterlein Univ. Tool & Cutter Grinder, b.d.
No. 54A Toledo Special Press, m.d.
No. 266B Toledo D.C. Press, belt, geared
No. 92½C Toledo D.C. Press, belt, geared
D2, DD2, DAG3 Ferracute Presses, belt
40" King Vertical Boring Mill, belt
62" Niles Vertical Boring Mill, m.d., p.r.t.
16" Springfield H.D. Shaper, m.d. thru gear box
16" Columbia H.D. Shaper, m.d. thru gear box
7" Rhodes Shaper, m.d.
No. 5A, 6A Potter & Johnston Automatics, s.p.d.
No. 2A, 3A Warner & Swasey Universal Turret Lathes, m.d., bar equip.
No. 2A, 3A Warner & Swasey Universal Turret Lathes, b.d., chucking
No. 1, 2, 4, 6, 8 Warner & Swasey Turret Lathes
14"x6' American H.D. Geared Head Engine Lathe, m.d., taper
18"x8' American H.D. Geared Hd. Eng. Lathe, m.d.
20"x8' American Geared Head Engine Lathe, m.d.
24"x10' American H.D. Geared Head Engine Lathe, m.d.
27"x16' American Geared Head H.D. Engine Lathe, m.d., taper
30"x12' American Geared Head Engine Lathe, m.d.
36"x14' American Geared Head Engine Lathe, m.d.
36"x40' American Geared Head Engine Lathe, m.d., taper
5' American Triple Purpose Plain Radial Drill, m.d. thru gear box
3', 4', 5', 6' Cincinnati Bickford Plain Radial Drills, gear box

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3260 Spring Grove Ave., Cincinnati, Ohio

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32"x12' B.&E., 3 S.C.D., D.B.G.
20"x10' American Grd. Hd. S.P.D.
24"x22' Bradford, Q.C., 3 S.C.D.
36"x16' Lodge & S. Sel. Grd. Hd.
30"x12' L.&S. Sel. Grd., Hd., M.D.
30"x14' L.&S., 3 S.C.D., D.B.G.
21"x10' LeBlond Geared Head
48"x34' Bridgeford Grd. Head Arr. M.D.

GRINDERS

16"x72" Landis Plain, Self Cont.
16"x48" and 72" Landis Crankshaft
Nos. 50, 55, 60, 65 and 70 Healds.

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No. 615 Fellows 24-H G. & E. Hobber
18-H Gould & Eberhardt Hobber
6", 11", 18" Gleason Gear Generators

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1½" Landis Sgl.-Sp., Grd. Hd. m.d.
1" Acme Class "A" single-spindle
2" Landis Sgl.-Sp., lead screw attach.
2" Landis Double-Spindle
18" Landis Pipe Threader

BORING MILLS

84" Cincinnati Rapid Production
24", 36" & 42" Bullard "New Era" A.C. Motor dr.
60" Niles Boring Mill, 2 heads

MILLING MACHINES

No. 2 Rockford Universal, complete
No. 4 Cincinnati Pl. Hi-Power, S.P.D.
No. 3-B Milwaukee Pl., Dbl. O. A.
Nos. 3; 5-B; 6 Becker Vertical
No. 2 Cin. H. P. Rect. O. A. m.t.b.
5" Pratt & Whitney Automati
Briggs Manufacturing Miller
No. 1 Knight Miller and Driller
42"x36"x12' Ingersoll, 4 Hds., Adj. Bl.

PLANERS

36"x30"x10' Cincinnati 2 Hds.
36"x36"x10' Gray, 2 Hds.

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2½, 3, 3½, 6' Cinci-Bick. S.P.D.
3, 3½, 4 American Trip Pur. S.P.D.
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16", 20", 24" G.&E., mtr. dr. thru g.b.

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No. 40 Landis, Floor Type, Boring Mill.
3' Fosdick Plain Radial Drill, gear box.
32" Barnes, All Geared, Upright Drill.
No. 13 Brown & Sharpe Universal Tool Grinder.
12"x36" Landis Plain Cylindrical Grinder.
16"x8' Handey Geared Head Tool Room Lathe, collets.
16"x8' Lodge-Shipley Lathe, Geared Head, lever apron.
No. 3-B Milwaukee Plain Milling Machine, double overarm.
No. 2 Cincinnati Vertical Milling Machine, slot nose.

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2—1¼" Cone, Motor Drive
2—No. 206 New Britain, six spindle, Motor Drive
4—⅜" Model G Gridleys, Motor Drive
2—9/16" Model G Gridleys. Motor Drive
1—2" Model M, 4 spindle, Cleveland, Motor Dr.
1—1½" Model M, 4 spdl., Cleveland, Motor Dr.
2—½" Model B, Cleveland, Belt Drive
2—2" Model B, 18 feed, Cleveland, Belt Drive
2—2" Model A, Cleveland, Belt Drive

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1—No. 2 B Rotary Gas Furnace.
2—Watghse. Elec. Nitriding Furnaces inside diam. 56"x4"x61", new, comp. with elec. equip.
10—Leeds and Northrup Hump Furnaces.

LATHES

2—12x5 Hendey, taper attach. and draw collets.
1—No. 9 Multi Cut LeBlond.
3—Lodge and Shipley 18"x8, heavy duty.
2—No. 7 Foster Turret. with air equipment.

GEAR CUTTERS

2—10" Gleason Spiral Bevel.
2—15" Gleason Spiral Bevel.
4—No. 7 Fellows, High Speed.
4—No. 3-26 B&S.

MISCELLANEOUS

1—No. 2-D, Edlund, 2 spindle drill press
2—Potter & Johnston, Dbl. Table Auto. Millers, & 2, 4 & 6 Spndl. Sipp & Abey Drill Presses.

Each machine is actually taken down, scraped, lined up, all worn parts renewed and carry our 100% REBUILT GUARANTEE. We also Tool Up and Install Machines, when desired.

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1—**Cincinnati** 72" Vertical Boring Mill; 2 swivel heads.
1—**Niles Bement Pond** 72" Vertical Boring Mill; 2 heads; extra heavy.
1—**NBP** 5" bar floor type Hor. Boring Mill.
1—**Gleason** 4" Spiral Bevel Gear Generator.
5—**Fellows** No. 7, 71 and 712 Gear Shapers.
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1—**American** 24"x16' Geared Head Lathe.
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1—**Bridgeford** 36"x40' MD lathe.
1—**Loy & Nawrath** No. 812 Press brake; 12' 6" bet. housings—tie rod.
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Brakes, Chgo. St., 3 to 10 ft. Hand & Power.
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Lathes, 16"x8 Pratt & Whitney; Grd. Hd. 16x6; Hendey 16x6 & 20x12; 19x8 LeBlond.
Millers Univ. No. 2 with Div. H. & Vert.H.; No. 3-A. B. & S. Motor Drive.
Shapers, 16" & 24" G. & E. SPD. & Cone Drive.

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WANTED

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Albany, N.Y. - Jersey City, N.J.

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Drill, Gang, 4-spdl. No. 2 Colburn Mfg. type.
Keyseater, 24"x2½" Morton., with attachments.
Lathe, 19"x10' LeBlond, Q.C.G., TA; chuck.
Lathe, 20"x10' Hendey (Yoke) QCG; TA; chuck.
Lathe, 20"x10½' G. H. Turret on Bed.
Lathe, 26"x16' Bridgeford G.H., TA; chuck.
Lathe, 36"x16' American G.H., TA; M.D.
Millers, Nos. 3 & 4 Ohio; No. 4-B. B&S.
Planer, Openside, 42x42x14' D&H, M.D.
Press, 57 Toledo tie rod 8" stroke.
Presses, No. 3A. Standard, Dial & Roll Feeds.
Presses, Bliss, Nos. 18, 21, 74½S & 78½.
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Mill, Horiz.—2½" bar Cleveland.
Mill, Vert.—52" and 62" King.
Pipe Machine—8" Oster.
Planer—36"x36"x12' Cincinnati.
Press—Nos. 5 and 6, Toledo O.B.I.
Slotter—30" Betts, M.D., P.R.T.

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SLOTTER—16-12" Dill, belt drive.
PLANER—30"x30"x14' Cincinnati, motor drive, box table, 2 heads, rapid traverse.
DRILL—Edlund 4 spindle B.B. power feed.
LATHES—20"x8' Hendey, belt, taper attach. 26"-48"x12' McCabe 2 in 1.
TURRETS—No. 2 Foster, fox lathe, never used. No. 5 Foster, 1 13/16" cap., motor drive.
PRESS—Waterbury Farrell, dbl. cr., bed 22x58".

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36" **Bullard New Era Vertical Boring Mill.**
36" x 15' **Bridgeford All Geared Engine Lathe.**
30" x 10' **Springfield Engine Lathe.**
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24" **Gould & Eberhardt Motor Driven Shaper with Universal Table.**
20" **Springfield Back Geared Shaper.**
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Potter & Johnston Double Table Automatic Milling Machine.
18" **Cincinnati Late Type Semi-automatic Milling Machine Motor Drive.**
2—7½ HP. **Motor Drive Safety Emery Wheel Snagging Grinders.**
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No. 2 **Brown & Sharpe Universal Grinder.**
3—½" **Landis Double Spindle Bolt Cutters.**
1—2" **Acme Double Spindle Bolt Cutter.**
2½" **Etna Power Swaging Machine.**
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Boring Mill, 42" King, one side head
Boring Mill, 42" Bullard "New Era"
Boring Mill, 48" Colburn, 2 plain heads
Boring Mill, 54" Colburn
Drills, 1, 2, 3, 4, 6 spdl. Leland-Gifford, B.B.
Drills, 21", 24" Cincinnati
Drill, No. 314 Baker, quick change
Drill, 3' American Radial
Drill, 4' Western Heavy Type
Radial, 6' American, triple grd., M.D.
Gear Hobbers, No. 9-H, 18-H Gould & Eberhardt
Gear Shapers, No. 7, 75, 715 Fellows
Grinder, No. 11—6"x32" Brown & Sharpe Plain
Grinder, 10"x36" Landis Plain, M.D.
Grinder, 14"x72" Norton Plain, M.D.
Grinder, 18"x96" Norton Plain, M.D.
Grinder, 20"x120" Landis Plain, M.D.
Grinders, No. 2½ Universal (Bath Type)
Grinder, No. 2 B. & S. Surface, mag. chuck
Grinder, No. 33 Abrasive Surf.
Grinder, 14" Pratt & Whitney Vert. Surface
Grinder, 15"x15"x72" Norton O.S. Surf.
Grinder, 8" Taylor & Fenn Internal
Lathe, 13"x6' Le Blond H.D., grd. bd.
Lathe, 16"x6' Lodge & Shipley Sel. Grd. Hd.
Lathe, 18"x8' American Geared Head
Lathe, 20"x14' Lodge & Shipley Sel. Grd. Hd.
Lathe, 20"x12' Lodge & Shipley Sel. Grd. Hd.
Lathe, 66"x36' Putnam Triple Geared
Miller, No. 2-M Cincinnati Plain
Miller, No. 2-B Milwaukee Plain
Millers, No. 3-B Heavy Brown & Sharpe, Plain
Miller, No. 4-B Milwaukee Plain
Miller, No. 4 Cincinnati Plain, High Power
Miller, No. 5-B Heavy Brown & Sharpe, Plain
Miller, No. 1-B Kearney & Trecker Universal
Miller, No. 1½ Rockford Universal
Miller, No. 2 Cincinnati Universal
Miller, No. 3-GS Hendey Univ., S.P.D.
Miller, No. 2-M Cincinnati Vertical
Miller, No. 6 Becker Vertical
Millers, 18" Cincinnati Duplex Automatic
Planer, 26" Lynd-Farquhar Open Side
Planer, 36"x36"x12' Detrick & Harvey, Open Side
Planer, 36"x36"x18' Cincinnati, M.D.
Planer, 72"x72"x12' Cincinnati, 4 heads
Press, No. 3 Rockford, O.B.I.
Press, No. 95-E Toledo Dble. Crank
Dieing Machine, 50-ton Henry & Wright
Shaper, 24" Cincinnati "Climax," S.P.D.
Turret Lathe, No. 1-A Warner & Swasey Universal
Turret Lathe, No. 3-A Warner & Swasey Universal
Turret Lathe, 18" Libby
Turret Lathe, 26"-7½" Libby
Turret Lathe, No. 4-L—9¼" Gisholt

Send for No 151 "Green List"—today

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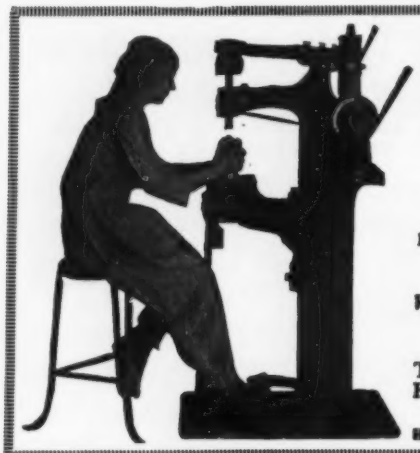

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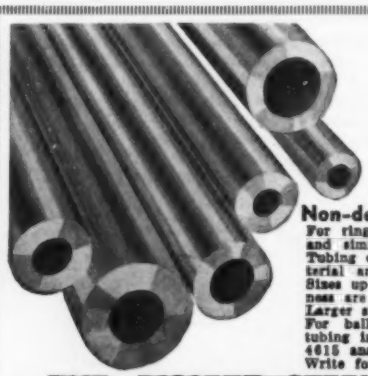

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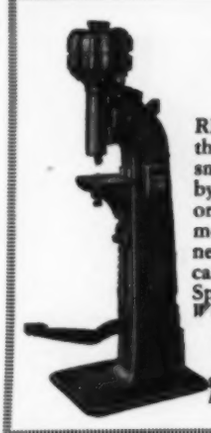

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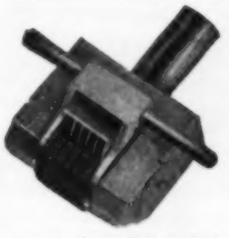

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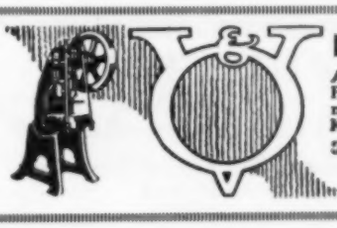

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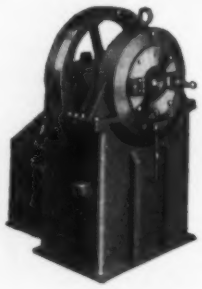

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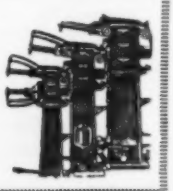

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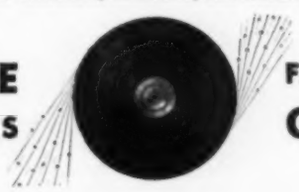

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